STATISTICS

OF THE

PRODUCTION OF COPPER IN THE CENSUS YEAR.

TABLE 49.—*Production of copper east of the 100th meridian.*

	State.	County.	Number of mines.	Maximum capacity of yearly production in pounds of metal.	Product census year in tons of ore or rock.	Product census year in pounds of ingot copper.	Value of product.	Value of materials or supplies used.	Wages paid.	Men employed above ground.	Men employed below ground.	Boys employed above ground.	Boys employed below ground.	Total employés.	Miners.	Laborers.
1	Michigan	Houghton	6	41,004,391	794,550	40,389,212	$7,068,111	$1,040,052	$2,171,451	1,840	1,995	105	20	3,960	1,513	2,291
2	....do	Keweenaw	4	7,815,603	79,695	3,764,723	622,826	150,632	392,361	306	447	27	.....	780	392	369
3	....do	Isle Royale	1	80,000	2,000	80,000	14,000	2,500	9,224	17	.....	1	.....	18	10	6
4	....do	Ontonagon	8	1,993,766	62,715	1,596,327	274,295	22,022	88,207	74	170	2	.....	246	161	76
	Total of Michigan		19	50,993,760	938,960	45,830,262	7,979,232	1,215,206	2,661,243	2,237	2,612	135	20	5,004	2,076	2,742
5	Maryland	Carroll	1	29,035	82	7,058	1,200	100	1,500	1	4	1	....	6	4	2
6	Missouri	Sainte Genevieve	3	3,920,000	1,051	230,717	25,730	2,102	14,059	12	29	.....	....	41	31	9
7	North Carolina	Ashe	2	4,080,000	24,680	1,640,000	350,000	61,000	133,631	200	103	25	.....	328	103	219
8	Pennsylvania	Montgomery	1	218,400	289	40,460	5,630	363	1,400	4	6	.....	.....	10	3	6
9	Vermont	Orange	1	2,647,894	28,037	2,647,894	469,495	102,479	265,231	262	272	37	48	619	201	406
10	Wisconsin	Iowa	1	31,097	62	18,087	1,549	84	339	1	2	4	.....	7	2	5
	Total		28	61,920,696	903,161	50,414,478	8,832,836	1,381,334	3,077,403	2,717	3,028	202	68	6,015	2,420	3,389

NOTE.—In addition to the above there were returned by Messrs. Pope, Cole & Co. the following amounts of ingot smelted by them, viz: 678 pounds from as having been produced from 17 tons of ore. In Pennsylvania 135,720 pounds of ingot copper, valued at $23,072, were produced in Lancaster county, from ore 270,000 pounds. From Montgomery county, in addition to the amount in the above table, there were produced, according to the smelting schedules, which furnished

The statistics from Maine, New Hampshire, and Tennessee are tabulated separately, because, in the case of the two first mentioned states, the mines are now situated so far from railroad that the value of the ore was returned as nominal. It likewise remained on the dump at the end of the census year.

11	Maine	Hancock	3	672,000	1,225	102,500	$18,040	$9,767	$36,500	38	37	.....	22	97	45	47
12	New Hampshire	Grafton	1	1,000	250	34,050	5,993	635	4,800	3	9	.....	.....	12	8	3
13	Tennessee	Polk	1	205,170	294	153,880	.....	.....	1,200	.....	4	.....	.....	4	4	.....

TABLE 49.—*Production of copper east of the 100th meridian.*

Administrative force.	Number of animals: horses, mules, and oxen.	Number of steam-engines.	Horse-power steam-engines.	Value of all machinery.	Value of explosives.	Cords of wood used for fuel.	Value of wood.	Timber.	Value of timber.	Sawed lumber.	Value of lumber.	Amount of working capital.	Value of plant.	Value of real estate.	Total capital.	
								Linear ft.		*Feet B. M.*						
156	82	76	9,318	$2,059,000	$159,084	68,957	$236,322	727,722	$108,172	2,988,000	$48,896	$785,000	$4,387,000	$23,447,000	$28,619,000	1
19	43	28	2,975	445,000	60,413	32,400	81,200	717,726	6,802	323,244	4,244	195,000	803,185	350,825	1,349,010	2
2	2	2	80	5,000	25	.....	.....	2,000	100	1,500	21	4,000	6,000	10,000	20,000	3
9	9	7	342	51,000	4,575	3,600	9,250	5,800	260	62,000	572	38,000	79,000	368,541	425,541	4
186	136	113	12,715	2,560,000	224,097	104,057	326,772	1,453,248	115,334	3 374,744	53,733	1,022,000	5,275,185	24,116,366	30,413,551	
.....	1	1	50	7,000	180	.....	.....	.....	.....	.....	.....	800	30,000	5,000	35,800	5
1	.....	.....	.....	.....	643	.....	.....	3,200	32	4,000	56	4,150	6,050	5,280	15,480	6
6	47	11	275	34,000	3,100	8,400	21,000	65,000	600	.....	.....	201,000	316,000	76,000	593,000	7
1	.....	1	6	1,000	16	.....	.....	5,000	125	4,200	42	500	1,000	7,000	8,500	8
12	57	3	230	20,800	5,832	4,700	15,275	.....	.....	500,000	6,000	100,000	125,000	275,000	500,000	9
.....	.....	.....	.....	.....	60	.....	.....	.....	.....	.....	.....	75	50	4,500	4,625	10
206	241	129	13,276	2,622,800	233,928	118,057	363,047	1,526,448	116,091	3,882,944	59,831	1,328,525	5,753,285	24,489,146	31,570,956	

Virginia ore, 922 pounds from Georgia ore, and 5,084 pounds from Texas ore, without further known data, and 1,275 pounds from Baltimore county, Maryland, reported containing nickel. The statistics of labor, etc., have been reported on the nickel schedules. The maximum yearly yield of copper from this source is estimated at no further data, 306 tons of ore, containing 38,556 pounds of ingot copper, valued at $6,554.

and the value of the ore could not be determined, none having been smelted previous to the close of the census year; and the mines of Tennessee, though old, are

5	10	5	$215	$10,000	$2,388	1,085	$3,000	5,000	$25	1,000	$100	$4,500	$71,500	$28,000	$104,000	11
1	2	1	20	1,800	100	182	182	25,000	78	.....	.....	1,000	10,000	10,000	21,000	12
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100	40	.....	140	13

TABLE 50.—*Production of copper west of the 100th meridian.*

State or territory.	Counties.	Number of mines.	Product census year in tons of ore or rock.	Product census year in pounds of ingot copper.	Value of materials or supplies used.	Wages paid.	Men employed above ground.	Men employed below ground.	Total employés.	Miners.	Laborers.	Administrative force.	Number of animals: horses, mules, and oxen.	Number of steam-engines.	Horse-power steam-engines.	Amount of working capital.	Value of plant.	Total capital.
Total		9	12,500	5,410,546	$90	$94,128	80	50	130	50	73	7	2	1	30	$50,000	$61,500	$111,500
Alaska			17	3,033														
Arizona	Apache	2	7,650	3,183,750		77,128	74	36	110	36	68	6	2			40,000	57,000	97,000
California	Amador	1	4,000	720,000	90	17,000	6	14	20	14	5	1		1	30	10,000	4,500	14,500
Colorado	Arapahoe, Jefferson			1,578														
Do																		
Idaho	Lemhi	2		150,000														
Montana			523	1,212,500														
Nevada	White Pine	4	357	134,730														
New Mexico			13	4,055														

ANALYSIS OF THE COPPER STATISTICS.

By Charles F. Johnson, Jr. (a)

All the ratios between production, wages, capital, number of mines, etc., are so controlled by the figures from one exceptionally productive mine in Houghton county, Michigan, that no general results can be drawn from the c subjoined table which would not be greatly changed, and in some cases reversed, if that mine were excluded from the consideration.

The product is reduced to metallic copper, and its value is given at the mines or at the point where it is no longer operated on by the labor reported in the schedule. In some cases both smelting and mining are carried on by the same establishment; in others the process of reduction is partly carried on at or near the mine, and the product, in the form of a "matte", is shipped to a distance; in others the ores of copper are mined and shipped without any preliminary reduction. Thus the industry, strictly speaking, embraces both mining and manufacturing, in a manner which renders it impossible to separate them.

The only common unit to which these various products can be reduced is evidently metallic copper, the value of which, per pound, to the mine producing, varies greatly, depending upon the expense and labor that must be d laid out upon it before it reaches the general market in the form of merchantable metal.

Under all these various conditions the average price realized by the mines has been 17.52 cents per pound.

The Lake Superior region furnishes 90.90 per cent. of the entire product given in the table. The production of $6,919 worth of native silver is also reported from this region. The 50,414,478 pounds of copper would make a cube whose edge would be 46 feet, or, in other words, would cover 26.73 acres with a sheet 1 inch thick.

The product is reported as equaling 81.57 per cent. of the "maximum capacity" of the mines. "Maximum capacity," however, represents in many cases rather the hopes and wishes of the manager than the probabilities of the mine. From the nature of the case it has a somewhat different significance from what it has when applied to iron or coal mining, where production from time to time outruns demand. The copper mines are worked continuously during the year, and for the industry as a whole "maximum capacity" may be taken to mean rather e the capacity of the machinery than of the mines.

We have regarded the return of "capital employed" as one of the most important we had to make, second only to those of wages and labor. Is is divided into three items of a totally different nature.

First: The "working capital", which was intended to represent the amount necessary to run the mine between production and sales. As returned it equals nearly four months' expenses, and may be assumed as a low average.

Second: The "plant" means all machinery, improvements, personal property (not supplies), animals, fixtures, etc. An estimate of this should be based on actual values, not cost, and should exclude all antiquated and idle machinery. The footing in the table is believed to be a very conservative estimate.

Third: "Real estate," as explained in the bulletins of iron ore and anthracite coal, means the mine itself as a mineral producer. Its value depends, of course, on the average price of copper during a term of years, and on the f reasonable expectation of productive life for each mine.

These three items make up all the substantial actual property of the industry, as it existed June 1, 1880, and an estimate of them for each mine is much more likely to approximate to true values than a mere return of share capital. The market value of the share capital has been, of course, used as a check whenever it was based on ability to pay dividends. The values sought for were not original cost nor selling price, but actual worth based on ability to contribute to the net industrial income of the country at large. Our aim has been to avoid overestimates, and to adopt a system that could be used for future comparisons for the purpose of illustrating industrial progress.

The "working capital" of the establishments is represented by copper on hand at the mines, or in transit to market. If it is carried after that point by the mines, they assume the character of metal brokers. We wish to restrict our report to industrial production simply. Therefore we assume that what we call "working capital" or

a Prepared for Census Bulletin No. 264. The figures have been corrected where necessary to make them agree with the final results.

a that portion which is not invested, but advanced out of production, is not jeopardized except by the inconsiderable fluctuations of price during a period of four months. Consequently it may be assumed that it need not earn more than 5 per cent. per annum. The "plant", however, like all mining plant, should earn not less than 30 per cent. to make good average expenditures for deterioration and replacement.

After deducting the proper sum for these two permanent charges, the net income of the copper mines of the eastern district is a little over two and a half millions of dollars. Assuming this to be paid annually, and taking 5 per cent. as the ruling rate of interest, the value of the real estate as reported would indicate an average expectation of a productive life of fifteen years for the copper mines on it; an expectation which it is believed that their average condition justifies. The fact that the income is paid at intervals shorter than one year shortens the b expectation considerably; but without taking this into consideration, it is evident that we have not fallen into the error of exaggerating the present value of the copper-producing property.

It requires, as will be seen by the tables, 62½ cents capital to produce a pound of copper per year. Of this, 77.5 per cent. represents the land (though the original outlay may have been much less); 18.40 per cent. of it is invested in the "plant", and 4.20 per cent. of it is required for wages advanced and supplies carried in the ordinary course of business. These averages apply to the industry as a whole, and of course vary greatly for different mines. Labor obtains about one-third of the value of the product, and nearly one-sixth is expended in the necessary mine supplies. The value of the yearly product is nearly 28 per cent. of the total capital.

The production of the extreme western states and territories (Colorado, Arizona, Idaho, California, Alaska, c Montana, Nevada, and New Mexico) is not included in the table. As far as received the production is 5,410,546 pounds, or 10.73 per cent. of the amount produced in the eastern district. Details from them will be given in the final report.(*a*)

Eleven new mines in Maine, Maryland, and New Hampshire report the employment of 162 men, the payment of $31,995 for wages, and $7,650 for material consumed. They have spent $658,470 for machinery, dead work, etc., but have produced no ingot copper. The returns from this class of mines are excluded from the tables, which are restricted to establishments of productive industry.(*b*)

The acknowledgments of the office are due to the agents of the copper mines throughout the country, especially to those of the Lake Superior district, for the promptness and courtesy with which they responded to our calls for information. Had the census year corresponded with the business year terminating January 1, the d questions could have been answered with much greater ease.

Table 49 (p. 798) contains the principal statistics of the copper-mining industry of the United States in the region east of the 100th meridian, during the census year ending May 31, 1880:

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a See p. 800. *b* See pp. 798, 799, note, and lower table.

STATISTICS

OF THE

PRODUCTION OF LEAD AND ZINC ORE EAST OF THE 100TH MERIDIAN IN THE CENSUS YEAR.

TABLE 51.—*Production of lead and zinc ore east of the 100th meridian, by counties.*

State.	County.	Number of mines.	CAPITAL.				LABOR.								WAGES.
			Total.	Real estate, buildings, and lands.	Plant, equipment, and animals.	Working capital.	Total employés.	Above ground.		Below ground.		Administrative force.	Miners.	Laborers.	Total amount paid.
								Men.	Boys.	Men.	Boys.				
Grand total		206	$7,442,983	$4,556,763	$2,138,155	$748,065	7,483	3,025	105	4,298	55	420	4,693	2,370	$2,640,265
Illinois	Jo Daviess	7	75,510	40,800	28,500	6,150	164	41	.....	123	.....	3	121	40	$47,502
Iowa	Clayton	1	185	150	10	25	2	.....	.....	2	.....	.....	2	.....	70
Do	Dubuque	10	16,019	6,809	5,965	3,245	55	13	1	41	1	2	43	10	9,401
Kansas	Cherokee	12	238,493	86,461	44,832	107,200	1,074	600	.....	1,074	.....	21	1,156	497	259,306
Maryland	Frederick	1	6,500	5,000	1,000	500	15	4	.....	10	1	2	10	3	5,000
Missouri	Christian	1	5,375	1,875	3,000	500	60	40	.....	20	.....	20	20	20	12,096
Do	Cole	2	575	400	100	75	6	.....	.....	6	.....	1	5	.....	868
Do	Dade	3	5,379	720	1,950	2,700	115	27	.....	88	.....	21	87	7	6,547
Do	Franklin	2	176,000	60,000	101,000	15,000	111	77	1	33	.....	13	38	60	41,000
Do	Greene	3	11,730	5,180	1,700	4,850	204	64	.....	140	.....	4	136	64	7,670
Do	Jasper	29	1,155,540	540,757	365,183	249,600	2,427	1,050	.....	1,377	.....	219	1,466	742	1,503,836
Do	Jefferson	4	36,682	21,400	15,012	270	24	7	.....	17	.....	1	21	2	1,496
Do	Madison	2	1,098,797	925,000	141,797	32,000	165	57	3	105	.....	11	105	49	110,063
Do	Moniteau	1	258	200	8	50	2	2	.....	.....	.....	.....	2	.....	.....
Do	Morgan	4	1,766	1,350	96	320	11	2	.....	9	.....	1	10	.....	530
Do	Newton	1	118,000	63,000	40,000	15,000	442	187	.....	255	.....	2	340	100	117,907
Do	Saint François	3	843,140	288,000	459,140	96,000	517	259	8	230	20	30	186	301	172,032
Do	Washington	14	634,802	442,225	138,487	54,150	410	176	9	233	1	18	307	94	55,754
Do	Wright	2	1,950	1,125	200	625	19	.....	9	10	.....	1	13	5	4,455
New Jersey	Sussex	5	817,000	664,000	86,000	67,000	187	81	7	99	.....	9	149	29	64,729
Pennsylvania	Lehigh	2	1,752,000	1,066,000	650,000	36,000	218	94	32	92	.....	14	52	152	78,100
Tennessee	Claiborne	1	7,150	5,000	150	2,000	35	35	.....	.....	.....	3	22	10	6,000
Do	Jefferson	2	10,700	6,500	2,100	2,100	45	41	4	.....	.....	3	24	18	4,188
Do	Knox	1	75,000	70,000	2,000	3,000	24	24	.....	.....	.....	4	20	.....	2,000
Do	Union	1	30,000	15,000	5,000	10,000	38	21	2	15	.....	1	25	12	17,000
Virginia	Wythe	2	215,700	170,500	25,200	20,000	138	43	15	60	20	6	46	86	27,875
Wisconsin	Grant	33	28,602	19,627	5,290	3,685	92	30	1	56	5	1	71	20	11,540
Do	Iowa	37	55,081	33,631	10,530	10,920	107	37	12	141	7	6	154	37	53,607
Do	La Fayette	20	24,089	15,084	3,905	5,100	77	14	1	62	.....	3	62	12	19,693

State.	County.	MATERIALS.			PRODUCTS.			ANIMALS.			
		Total value of all materials.	Value of explosives.	Value of other materials.	Lead ore.	Zinc ore.	Other ores.	Horses.		Mules.	
								Number.	Value.	Number.	Value.
					Tons.	*Tons.*	*Tons.*				
Grand total		$331,970	$145,656	$186,314	53,140	123,868	10,194	136	$10,870	118	$11,215
Illinois	Jo Daviess	5,422	643	4,779	772	3,000	.....	2	100	.....	.....
Iowa	Clayton	.....	.....	.....	1	.....	.....	.....	.....	.....	.....
Do	Dubuque	5,297	118	5,179	383	.....	.....	4	300	.....	.....
Kansas	Cherokee	64,260	51,674	12,586	10,681	7,248	.....	26	1,950	8	900
Maryland	Frederick	400	100	300	.....	672	2	.....	.....	.....	.....
Missouri	Christian	1,000	500	500	432	.....	.....	.....	.....	.....	.....
Do	Cole	55	15	40	30	.....	.....	.....	.....	.....	.....
Do	Dade	1,450	825	625	48	251	.....	.....	.....	.....	.....
Do	Franklin	7,300	825	6,475	215	.....	.....	9	870	.....	.....
Do	Greene	3,775	3,135	640	636	43	.....	1	85	.....	.....
Do	Jasper	76,386	39,604	36,782	10,878	21,304	.....	23	2,025	18	2,150
Do	Jefferson	55	22	33	56	.....	.....	.....	.....	.....	.....
Do	Madison	14,582	4,120	10,462	3,581	.....	.....	4	300	2	160
Do	Moniteau	5	.....	5	3	.....	.....	.....	.....	.....	.....
Do	Morgan	70	30	40	64	.....	.....	.....	.....	.....	.....
Do	Newton	26,000	10,000	16,000	1,289	9,550	.....	.....	.....	.....	.....
Do	Saint François	56,645	16,794	39,851	9,844	2,239	.....	10	675	31	2,540
Do	Washington	7,080	793	6,287	1,185	606	.....	10	650	35	3,450
Do	Wright	129	90	39	54	351	.....	.....	.....	.....	.....
New Jersey	Sussex	15,292	2,694	12,598	.....	30,381	10,192	5	500	2	250
Pennsylvania	Lehigh	30,040	8,750	21,290	.....	20,450	.....	11	900	8	775
Tennessee	Claiborne	500	75	425	.....	1,120	.....	.....	.....	.....	.....
Do	Jefferson	508	15	493	60	115	.....	6	400	.....	.....
Do	Knox	200	50	150	.....	224	.....	.....	.....	.....	.....
Do	Union	4,500	1,500	3,000	.....	2,240	.....	2	200	5	500
Virginia	Wythe	2,700	1,004	1,696	11,200	10,448	.....	7	360	8	430
Wisconsin	Grant	1,226	358	868	667	220	.....	4	185	.....	.....
Do	Iowa	4,731	1,466	3,265	481	3,975	.....	8	550	1	60
Do	La Fayette	2,362	456	1,906	580	422	.....	4	220	.....	.....

TABLE 51.—*Production of lead and zinc ore east of the 100th meridian, by counties*—Continued.

State.	County.	STEAM-POWER.						MACHINERY.					Remarks.
		Engines.			Boilers.			Hoisting-machines, number.	Pumps and pumping-machines.		Total number machines of every kind.	Total value of all machines.	
		Number.	Value.	Horse-power.	Number.	Value.	Horse-power.		Number.	Value.			
Grand total		167	$462,822	6,739	209	$150,700	6,707	503	222	$97,941	1,479	$476,295	
Illinois	Jo Daviess	3	6,000	240	4	5,700	300	15	5	6,475	31	22,245	The remarks for Wisconsin apply here also. The following figures are taken from the Lead and Zinc Smelting and Reduction Works schedules: Illinois ores, received by reduction-works during census year: Galena, 2,078,230 pounds; zinc (blende), 170,400 pounds; zinc (silicate), 14,200,000 pounds.
Iowa	Clayton												The remarks on the grand total sheet for Wisconsin apply here also. The following figures are taken from the Lead and Zinc Smelting and Reduction Works' schedules: Iron ores received by reduction-works during the census year: Galena, 1,990,587 pounds; zinc (silicate), 72,510 pounds.
Do	Dubuque	1	3,000	25	3	800	50	12	4	715	15	5,235	
Kansas	Cherokee	14	4,900	268	12	4,750	285	115	18		226	33,210	The remarks for Missouri (lead and zinc) apply here also. The following figures are taken from the Lead and Zinc Smelting and Reduction Works' schedules: Kansas ores received by reduction-works during census year: Galena, 20,925,106 pounds; lead (carbonate), 1,340 pounds; zinc (blende), 5,965,000 pounds.
Maryland	Frederick								1	30	1	30	
Missouri	Christian												These statistics, as well as those of lead and zinc for Kansas, were collected by Professor W. B. Potter, of Saint Louis.
Do	Cole										8	23	
Do	Dade	1	200	10	1	200	10				1	400	*Wages and time:* The average monthly earnings, as ascertained by dividing wages by product of "employés" and months worked, show that wages may run from $50 or more to nothing a day. Professor Potter, in explaining this, states that the time returned includes time spent prospecting, and that men are paid by the 1,000 pounds of ore.
Do	Franklin	4	8,000	73	4	3,050	175	9	6	5,000	25	21,000	
Do	Greene							5			5	440	
Do	Jasper	71	51,510	1,465	76	45,400	1,787	102	109	55,324	450	184,367	
Do	Jefferson	2	800	74	2	600	60	14	2	500	17	2,063	
Do	Madison	7	3,372	80	8	5,100	166	7	13	4,747	63	27,219	The following figures are taken from the Lead and Zinc Smelting and Reduction Works' schedules, and show the Missouri ores received during census year: Galena, 29,543,345 pounds; lead (carbonate), 314,889 pounds; zinc (blende), 40,051,415 pounds; zinc (carbonate), 7,901,080 pounds; zinc (silicate), 50,037,560 pounds; besides slag for white-lead from Missouri furnaces, 3,203,100 pounds.
Do	Moniteau										1	3	
Do	Morgan										5	15	
Do	Newton	17	6,000	198	22	9,075	287	98	22	8,500	165	29,425	
Do	Saint François	12	12,650	797	21	14,300	101	31	18	6,710	106	70,469	
Do	Washington	4	1,040	108	5	3,000	116		1	550	78	6,151	
Do	Wright												*Deficiencies:* No returns could be obtained from the "*Broadway Diggings*", at *Joplin*. *The mines are* operated by a number of parties, and no records are kept.
New Jersey	Sussex	10	7,250	170	11	4,825	230	11	6	4,700	20	33,000	
Pennsylvania	Lehigh	15	353,000	3,100	34	51,100	3,100	3	4	3,000	44	31,100	
Tennessee	Claiborne												The following figures are taken from Smelting and Reduction Works' schedules (Lamaghi Zinc-Works, Collinsville, Madison, Illinois): Carbonate of zinc received from Tennessee during census year, 300,000 pounds.
Do	Jefferson	1	400	8	1	400	8				2	1,300	
Do	Knox												
Do	Union	2	1,500	26	2	1,000	26						
Virginia	Wythe								3	75			
Wisconsin	Grant							24	1	400	28	840	Capital in real estate, when not returned, has been estimated as equal to the royalty on three full years' production at the rate of the monthly production during the census year.
Do	Iowa	1	300	10	1	400	10	33	2	115	43	3,000	
Do	La Fayette	2	800	27	2	400	26	24	7	1,100	55	3,570	Working capital estimated as equal to "labor" and "materials" for two months.
													Wages represent in many cases the value of labor and the profit in the business, as the mines are generally operated by two or three miners working in a partnership, and doing all the work themselves.
													Materials include powder, lumber, and feed, fuel, etc.
													The following figures are taken from the Lead and Zinc Smelting and Reduction Works' schedules, and show the Wisconsin ores received during census year: Galena, 7,050,000 pounds; zinc (blende), 468,000 pounds; zinc (carbonate), 637,340 pounds; zinc (silicate), 751,930 pounds.

TABLE 52.—*Production of lead and zinc ore east of the 100th meridian, by states.*

States.	Number of mines.	CAPITAL.				LABOR.							WAGES.
		Total.	Real estate, buildings, and land.	Plant, equipment, and animals.	Working capital.	Total employés.	Above ground.		Below ground.		Administrative force.	Miners.	Laborers.	Total amount paid.
							Men.	Boys.	Men.	Boys.				
Grand total	206	$7,442,983	$4,556,763	$2,138,155	$748,065	7,483	3,025	105	4,298	55	420	4,693	2,370	$2,640,265
Illinois	7	75,510	40,860	28,500	6,150	164	41	.....	123	.....	3	121	40	47,502
Iowa	11	16,204	6,959	5,975	3,270	57	12	1	43	1	2	45	10	9,471
Kansas	12	238,493	86,461	44,832	107,200	1,674	600	.....	1,074	.....	21	1,156	497	259,306
Maryland	1	6,500	5,000	1,000	500	15	4	.....	10	1	2	10	3	5,000
Missouri	71	4,090,054	2,351,241	1,207,673	471,140	4,522	1,948	30	2,523	21	342	2,736	1,444	2,634,254
New Jersey	5	817,000	664,000	86,000	67,000	187	81	7	99	.....	9	149	29	64,729
Pennsylvania	2	1,752,000	1,066,000	650,000	36,000	218	94	32	92	.....	14	52	152	78,100
Tennessee	5	122,850	96,500	9,250	17,100	142	121	6	15	.....	11	91	40	29,188
Virginia	2	215,700	170,500	25,200	20,000	138	43	15	60	20	6	46	86	27,875
Wisconsin	90	108,672	69,242	19,725	19,705	366	81	14	259	12	10	287	69	84,840

States.	MATERIALS.			PRODUCTS.							ANIMALS.			
	Total value of all materials.	Value of explosives.	Value of other materials.	Lead ore.	Value.	Zinc ore.	Value.	Other ores.	Value.	Total value of all products.	Horses.		Mules.	
											Number.	Value.	Number.	Value.
				Tons.		*Tons.*		*Tons.*						
Grand total	$331,970	$145,656	$186,314	53,140	$2,102,048	123,868	$1,734,213	10,194	.....	.....	136	$10,870	118	$11,215
Illinois	5,422	643	4,779	772	30,200	3,000	39,000	.....	.....	.....	2	100	.....	.....
Iowa	5,297	118	5,179	384	19,172	.....	.....	.....	.....	.....	4	300	.....	.....
Kansas	64,260	51,674	12,586	10,681	400,980	7,248	131,169	.....	.....	.....	26	1,950	8	900
Maryland	400	100	300	.....	.....	672	7,200	2	.....	.....	.....	.....	.....	.....
Missouri	194,532	76,753	117,779	28,315	1,478,571	84,344	599,373	.....	.....	.....	57	5,205	86	8,300
New Jersey	15,202	2,694	12,508	.....	.....	39,381	451,070	10,192	.....	.....	5	500	2	250
Pennsylvania	30,040	8,750	21,290	.....	.....	20,459	394,568	.....	.....	.....	11	900	8	775
Tennessee	5,708	1,640	4,068	60	2,500	3,699	23,145	.....	.....	.....	8	600	5	500
Virginia	2,700	1,004	1,696	11,200	33,000	10,448	24,126	.....	.....	.....	7	360	8	430
Wisconsin	8,319	2,280	6,039	1,728	78,525	4,617	64,562	.....	.....	.....	16	955	1	60

States.	STEAM-POWER.						MACHINERY.				
	Engines.			Boilers.			Number of hoisting-machines.	Pumps and pumping-engines.		Total number of machines of every kind.	Total value of all machines.
	Number.	Value.	Horse-power.	Number.	Value.	Horse-power.		Number.	Value.		
Grand total	167	$462,822	6,739	209	$150,706	6,797	563	222	$97,941	1,479	$476,295
Illinois	3	6,000	240	4	5,700	300	15	5	6,475	31	22,245
Iowa	1	3,600	25	3	800	50	12	4	715	15	5,235
Kansas	14	4,900	208	12	4,750	285	115	18	.....	226	33,210
Maryland	.....	.....	.....	.....	.....	.....	.....	1	30	1	30
Missouri	118	85,072	2,895	139	81,331	2,702	266	171	81,331	1,014	342,165
New Jersey	10	7,250	170	11	4,825	230	11	6	4,700	20	33,000
Pennsylvania	15	353,000	3,160	34	51,100	3,160	3	4	3,000	44	31,100
Tennessee	3	1,000	34	3	1,400	34	.....	.....	.....	2	1,300
Virginia	.....	.....	.....	.....	.....	.....	.....	3	75	.....	.....
Wisconsin	3	1,100	37	3	800	36	81	10	1,615	126	8,010

THE INDUSTRIES OF THE BASE METALS

(LEAD, ZINC, AND COPPER)

IN THE CENSUS YEAR.

THE INDUSTRIES OF THE BASE METALS (LEAD, ZINC, AND COPPER).

By George H. Eldridge.

To present as nearly as possible a correct idea of the metallurgy of the base metals throughout the United States, there should be given a concise description of the methods pursued in the treatment of their ores, together with a detailed statement of the conditions under which they are conducted; but, though the data are at hand, time necessary for such a lengthy discussion is lacking, and, therefore, nothing beyond a complete statistical representation of the several industries, with such explanatory notes as may be necessary, will be attempted.

As attesting the value of the tables, it should be stated that their compilation is based on a thorough personal investigation of each of the processes in use, such investigations, with a few unavoidable and unimportant exceptions, having been carried to every establishment east of the 100th meridian. In the few instances where a personal visit could not be paid, the essential data were obtained by letter.

Before passing to an inspection of the tables, it should be understood that throughout this entire article all statistics are based on the ores actually smelted between June 1, 1879, and May 31, 1880; that the materials, hours of work, wages, etc., are the amounts consumed in extracting the product given from this ore; and that no connection exists between smelting and mining operations, except in a very broad way.

Concerning the arrangement of the tables the forms offered have been deemed the most expedient, since the information gained has been given in strict confidence, and there is a necessity of guarding against any arrangement that would tend to give publicity, either directly or indirectly, to individual operations.

In lead smelting, the arrangement by states has been very closely adhered to, but Virginia and Tennessee, each possessing one smelter, were placed together under "South and east of the Ohio river". Under zinc the "Eastern" works comprise those in the states of New Jersey, Pennsylvania, and Virginia, which, excepting the Bertha Zinc works in Virginia, have also an additional product of zinc oxide. Respecting these, the facts given relate solely to their metallurgical work, and no account has been taken of the supplies (excepting ore consumed), wages, or capital employed in the production of zinc oxide. This product has been given as showing the outcome of the ore worked up, and the ore was given as being of interest in connection with the other ores of the same kind consumed in purely metallurgical processes. The copper works of the "East" comprise those of Vermont, eastern Pennsylvania, Maryland, and North Carolina, none smelting native copper. The two smelters in western Pennsylvania and Michigan comprise the "Western works", both working on native copper alone.

The smelting and refining works comprise those in Omaha, Chicago, Pittsburgh, Saint Louis, and Newark, and are necessarily brought under the general designation of "United States, east of the 100th meridian".

Nickel would have been included in the production of the base metals, but for the fact that there is only one producer of the metal in the United States, though a large one and well worthy of notice.

THE LEAD INDUSTRY.

Under this head are brought all those establishments concerned in the working of lead ores, for the product "lead" and any slight accessory "products of nickel, cobalt, and copper" that may be obtained at the same time. They are representative of four different processes—the *Corinthian*, the *Scotch hearth*, the *blast furnace*, and the *Flintshire*, their statistics being presented under their respective heads in Table 54.

TABLE 53.—*Lead-smelting works, by states, etc.*

	UPPER MISSISSIPPI REGION.							
	Total.		*Illinois.*		Iowa.		Wisconsin.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Number of counties	5		1		1		3	
Number of establishments	22		5		3		14	
MATERIALS.								
Fuel used in reducing ores, etc.:								
Coke ..... pounds..	200,800	$961	26,000	$121	26,400	$151	148,400	$689
Charcoal ..... bushels..	4,092	408	805	161	1,030	122	2,257	245
Wood ..... cords..	1,462	5,927	155	790	130	685	1,177	4,452
Fuel used for power:								
Coal ..... pounds..	19,000	43			19,000	43		
Wood ..... cords..	22	70					22	70
Other supplies:								
Finished materials ..... value..		2,628		450		610		1,568
Total value of all supplies		10,100		1,462		1,611		7,033
Ores reduced:								
Galena ..... pounds..	12,098,895	323,164	2,457,404	69,066	1,987,582	54,752	7,653,909	199,346
LABOR.								
Skilled laborers ..... No..	32		7		3		22	
Days employed ..... No..	5,075		866		672		3,537	
Net wages		9,010		1,349		847		7,714
Ordinary laborers ..... No..	42		8		7		27	
Days employed ..... No..	8,055		1,454		1,624		4,977	
Net wages		10,106		1,658		2,059		6,389
Total wages		20,016		3,007		2,906		14,103
PRODUCTION.								
Pig-lead ..... pounds..	8,182,039	383,511	1,685,797	79,514	1,394,824	63,140	5,101,418	240,857
CAPITAL.								
Capital, fixed		63,310		16,200		15,300		31,810
Capital, floating		91,300		18,000		10,000		63,300

TABLE 54.—*Lead smelting works, by states, etc.*—Continued.

	LOWER MISSISSIPPI REGION.						SOUTH AND EAST OF OHIO RIVER REGION.	
	Total.		Kansas.		Missouri.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Number of counties	11		1		10		2	
Number of establishments	33		3		30		2	
MATERIALS.								
Fuel used in reducing ores, etc.:								
Coal ..... pounds..	2,476,400	$7,446			2,476,400	$7,446		
Coke ..... pounds..	6,338,860	28,008			6,338,860	28,008		
Charcoal ..... bushels..	134,599	10,930	30,588	$2,559	104,011	8,371	10,000	$500
Wood ..... cords..	11,143	21,171	68	122	11,075	21,049	956	573
Fuel used for power:								
Coal ..... pounds..	9,105,542	9,570	815,542	1,020	8,290,000	8,550		
Wood ..... cords..	11,148	22,182			11,148	22,182	10	38
Other supplies:								
Fluxes ..... value..		19,093		612		19,381		
Finished materials ..... value..		26,017		1,064		24,953		600
Total value of all supplies		146,817		6,277		140,540		1,711
Ores reduced:								
Galena ..... pounds..	79,024,976	1,902,558	9,176,500	234,056	70,448,476	1,728,502	1,912,000	27,303
Dry bone ..... pounds..	82,200	1,009			82,200	1,009		
Total of all ores of each metal ..... pounds..	79,707,176	1,903,567	9,176,500	234,056	70,530,676	1,729,511	1,912,000	27,303
LABOR.								
Skilled laborers ..... No..	353		40		313		4	
Days employed ..... No..	70,333		6,981		72,352		750	
Net wages		153,826		13,931		139,895		1,125
Ordinary laborers ..... No..	290		9		281		5	
Days employed ..... No..	74,207		1,326		72,881		1,050	
Net wages		98,401		2,159		96,242		1,050
Total wages		252,227		16,090		236,137		2,175
STAFF.								
Number	27		4		23			
Total salaries		37,468		4,720		32,748		
PRODUCTION.								
Pig-lead ..... pounds..	57,425,151	2,750,424	6,365,551	295,044	51,059,600	2,404,380	886,808	35,500
Nickel and cobalt mattes ..... pounds..	38,293	5,514			38,293	5,514		
White-lead ..... pounds..	2,156,100	86,244			2,156,100	86,244		
Blue-lead ..... pounds..	348,489	12,197			348,489	12,197		
Total value of product		2,863,379		295,044		2,568,335		35,500
CAPITAL.								
Capital, fixed		802,039		14,332		787,707		16,000
Capital, floating		333,945		30,000		303,945		16,000

a TABLE 54.—*Lead-smelting works, by states, etc.*—Continued.

GRAND TOTAL.

	Quantity.	Value.		Quantity.	Value.
Number of counties	18		LABOR.		
Number of establishments	57		Skilled laborers.....No..	380	
MATERIALS.			Days employed.....No..	85,158	
Fuel used in reducing ores, etc.:			Net wages		$164,891
Coal.....pounds..	2,476,400	$7,446	Ordinary laborers.....No..	337	
Coke.....pounds..	6,539,660	20,569	Days employed.....No..	83,312	
Charcoal.....bushels..	148,691	11,898	Net wages		109,557
Wood.....cords..	13,561	27,071	Total wages		274,448
Fuel used for power:			STAFF.		
Coal.....pounds..	9,124,542	9,013	Number	27	
Wood.....cords..	11,180	22,299	Total salaries		37,468
Other supplies:			PRODUCTION.		
Fluxes.....value..		19,993	Pig-lead.....pounds..	66,494,058	3,178,435
Finished materials.....value..		30,145	Nickel and cobalt mattes.....pounds..	38,293	5,514
Total value of all supplies		158,634	White-lead.....pounds..	2,156,100	80,244
Ores reduced:			Blue-lead.....pounds..	348,480	12,197
Galena.....pounds..	93,635,871	2,313,025	Total value of product		3,282,390
Dry bone.....pounds..	82,200	1,009	CAPITAL.		
Total of all ores of each metal.....pounds..	93,718,071	2,314,034	Capital, fixed		875,349
			Capital, floating		435,245

The figures here presented consist of many widely varying components which must be briefly noticed.

The coal, both for power and for smelting, is supplied by two fields, 8,920,982 pounds by the Kansas, and 2,679,960 pounds by the Illinois field, chiefly the Big Muddy.(*a*)

The prices of the coals at the furnaces were: For the Western Missouri district, $1 90 per ton, the Kansas
d coal-field being distant only 35 miles, while for the Eastern Missouri region the average price was $6 23½ per ton, the field being distant, by transportation routes (rail), 130 miles, though in a direct line only 40 or 50 miles. By comparing the price of Kansas coal, as above stated, with that in the bituminous coal table, there appears the somewhat strange fact that the price at the furnaces, 35 miles distant (via rail), is less than that at the shaft. In explanation, it should be noted, on the one hand, that the figures in the coal table represent the average price for Kansas coal for the entire field as determined by mining returns, but, on the other hand, from personal inquiries among the smelters, it is learned that their coal can be purchased in large quantities at a certain mine for 80 cents to $1 12½ per ton, the latter being nearer the usual price, the former exceptional. In the eastern part of the state the railroads are apparently reaping the chief benefit, the price of Illinois coal averaging $1 44 at the mine and $6 23½ at the furnaces, while the distance carried is only about four times as great as in the west.

e No special notice need be taken of the very insignificant amount consumed by the Iowa smelters.

The sources of coke were four; Cincinnati, Illinois, Georgia, and Connellsville, furnishing as follows:

Locality.	Quantity.	Percentage.
	Pounds.	
Cincinnati	22,000	00.3
Illinois	2,460,500	37.6
Georgia	1,607,160	24.6
Connellsville	2,450,000	37.5
Total	6,539,660	100.0

f

The first three quantities went to eastern Missouri, while the Connellsville coke was distributed over the entire area, 92 per cent. of it, however, going to southwest Missouri.

We will not compare the prices, as, owing to the varying distances and freights, it would signify nothing.

The charcoal was invariably made in the vicinity of the works using it, and ranged from 5 to 10 cents per bushel in Missouri, and from 10 to 15 cents in the Upper Mississippi district.

a The relative percentages of these (77 and 23, respectively, of the whole amount) have widely changed since the census year, owing to the gradual substitution of coal for wood by the larger Eastern Missouri works, the additional supply being drawn from the Illinois field.

Wood is also found in the immediate vicinity of the furnaces, and where the Corinthian process is in use will a undoubtedly continue to supply all demands of the smelters, as they usually work in a desultory manner, lying idle both during the months devoted to agriculture, and at other times, whenever there may be a lack of "mineral." The drain upon the forests by the above class of smelters is light, requiring, as they do, no power and no large furnaces, the excessive drain being made by the larger works in roasting ores, and running their heavy engines and the machinery of their dressing-works. At the time of visiting eastern Missouri, a drain of about 100 cords per day was made by the large companies alone, but as mineral fuel is fast supplanting vegetable, within a very short time the annual consumption in this locality will probably be lessened by at least 15,000 cords.

It was found impossible to present a more detailed statement of "other supplies" with any reliable approach to the truth, since the supplies comprising this column—iron, wrought and cast, fire-brick, oil for various uses, b fluxes of various kinds, etc.—were not only usually accounted for in a general way only, but, moreover, those purchased in one year were largely consumed in another; consequently, to present a comparable view, averages at each of the works were taken, based upon the amount of product turned out during the census year.

Quantities of lime, too small to note, were used in each of the states, but the only localities employing fluxes to an appreciable degree were those of Missouri and Kansas. The tabular figures would be distributed thus:

	Quantity.	Value.
Iron ore.....tons..	1,500	$14,558
Limestone.....do...	293	316
Fluor spar.....do...	130	1,548
Lime.....bushels..	13,493	2,706
Sand .....tons..	1,000	865

c

The value of sand is purely arbitrary. It will at once be seen by what class of smelters the different fluxes are used.

Ores reduced.—Possibly a more appropriate and representative term than "ore" would be "mineral", the name by which the raw material is known, as it goes to the furnace in its prepared state. It is this to which the figures in the tables refer, and by it a more satisfactory comparison between states can be made, inasmuch as a common standard, "mineral" yielding practically from 60 to 75 per cent. of lead, is obtained. This mineral comes from d two classes of ore—that requiring only hand dressing and washing, which forms 73 per cent. of the total amount, and that containing only about 6 per cent. of galena, and requiring the aid of machinery to bring it to the required standard, which constitutes the other 27 per cent. The former has a general distribution over the entire field, and is smelted in air-furnaces and Scotch hearths, while the latter class occurs in only two localities, both in eastern Missouri, and is entirely smelted by three concerns, the blast and Flintshire furnaces being used in its reduction.

The values of the year's purchases ranged from $13 to $30 per 1,000 pounds, the predominating figures, as shown in the schedule, being $27. Aside from this, and computed from the figures expressed in the table, the average price for the several states would be: Illinois, $28 11; Iowa, $27 54; Wisconsin, $26 04; average for the region being $26 71. Kansas, $25 50; Missouri, $24 53; average for the region being $24 65. East, $14 28.

In the first three states, while the purchases are not based on a sliding-scale, they are, nevertheless, somewhat governed by the price of "pig-lead" in Chicago, as, for instance, when lead is worth $4 37 per 100 pounds in e Chicago, mineral brings about $25 per 1,000, but the variation from this is not proportionate. Usually, however, the prices fixed are at sight of ore at the mouth of the mine-shaft. In Missouri and Kansas, on the other hand, a closer adherence to an established basis is practiced. In the southwest section it is as follows: For mineral produced on company land, $25 per 1,000 pounds net, at the mine, when pig-lead in Saint Louis is worth 7 cents per pound, and varying in proportion. For "neutral mineral" the price is not regulated as above, but payment is made at sight, at the mouth of the shaft, at the price agreed on. The smelting company transports.

In eastern Missouri purchases are based on Saint Louis prices, but by a little different arrangement, viz: For private mineral the market value of 500 pounds of lead is given for 1,000 pounds net of mineral; for public mineral, which corresponds to the neutral of western Missouri, the value of 600 pounds of lead is given for 1,000 pounds of f mineral. On private mineral the less price covers royalty, whereas, when purchased from public lands, the miner must pay the royalty after receiving his due from the smelter. In all cases the smelter does all the hauling. This gives a concise idea of the general manner in which purchases are made in the field. In southwestern Missouri the price is at times a little influenced by a price given by one company in advance of the current market value.

Attention is called to a difference of 8½ per cent. between the lead ores actually smelted and those returned on the mining schedules, the former being in excess 4,023 tons. Referring to the respective tables, and regarding Missouri and Kansas as one region, and Illinois, Iowa, and Wisconsin as another, it will be observed that in the former the returns of the smelters exceed the mining returns only 857 tons, or 2 per cent. of the entire amount smelted. This is due to the fact that while smelting furnaces are easily discovered, it is quite the contrary with mines worked by two or three men each.

a Between the two returns of the second region is a large difference of 3,166 tons, or a little over 50 per cent. of the total smelters' returns. The same difficulty regarding obscure mines as was met with in the southwestern region exists here in a much greater degree. For this reason the return of the smelting operations is more nearly correct as to the amounts of ores mined. (*a*)

Labor.—The division of labor into skilled and ordinary has been made largely upon a basis of wages paid, rather than entirely upon the actual quality of mechanics' or smelters' work. Had this latter mode of division been carried out the number of "skilled" laborers would have been reduced to about 100, and the ordinary laborers would have been correspondingly increased. When considered in conjunction with the labor of all trades in the United States, undoubtedly this last method should be adopted; but in the consideration of lead-smelting b alone, the method of division adopted seems the more appropriate, for while the quality of work may not reach the standard of the "skilled" workman in many trades, there is, nevertheless, not only a wide difference in most cases in the pay, but as well in the degree of responsibility. This has influenced likewise the daily wages earned by each of the two classes, and perhaps no better insight into the character of labor and wages can be gained than by the inspection of the average wages per day given herewith:

c

Region.	Skilled labor.	Ordinary labor.	Percentage of per diem wages for skilled labor paid for unskilled labor.
Illinois	$1 56	$1 14	73
Iowa	1 27	1 26	100
Wisconsin	2 18	1 28	59
Kansas	1 99	1 63	82
Missouri	1 93	1 32	68
South and east of Ohio river	1 50	1 00	67
Average	1 93	1 31	68

It is observed that for the entire country the day's wages for "ordinary" labor averages 68 per cent. of that for skilled labor.

d Missouri, where smelting operations are conducted on the most firmly-established basis, and which wields the greatest influence both in the number of laborers and in the methods of treatment pursued, is found to agree most closely with this ratio; south and east of the Ohio river coming next. Kansas would naturally vary from it, for not only is the average made from few (three) establishments working side by side, but also the method of reducing ores is uniform, being the Scotch hearth. In Wisconsin the gap between ordinary and skilled labor appears greatest. By the schedule it would seem that the smelter for the same class of work received from $1 to $3 50 per day, and the only manner in which this wide variation of payment for the same work can be accounted for, is the scarcity of responsible "skilled" labor in a certain district, for the excessively high wages are paid in only one locality. "Ordinary" labor, on the other hand, is to be had with much greater ease. In Iowa, strictly speaking, no division between "skilled" and unskilled labor should be made, unless that one man was nominally held more e responsible than the other. In Illinois the conditions are somewhat similar to those of Kansas.

As to the kinds of labor, it may be noted that the dressing and smelting of lead ores require three classes, the mechanic, the smelter, and the millman, the skilled of one class receiving about the same as those of another class. The millman is employed only in Missouri, where dressing-works exist, while the mechanic and the smelter have a universal distribution. Except in the case of the large companies necessarily requiring dressing-works on account of the very low grade of ore used, the preliminary treatment of the ore consists merely in a hand-sorting, and subsequent washing of its dirt by means of hand-jigs placed over small streams, which operations are usually performed by the miner, before sales, but sometimes by the smelter, who then deducts a certain amount from what would otherwise be paid to the miner.

f As to the relative proportion of "skilled" to ordinary labor, no definite statement can be made for the arrangement by states, this depending entirely upon the kind of processes and number of each employed, and the proportion existing between these two divisions in any state would be entirely changed by a change in the mode of treatment.

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a In addition to the figures for ore received and product obtained, together with their respective values given in the table, there is a by-product of the zinc works of Illinois (Table 59 and page 82), resulting from the working up of 680,000 pounds of mineral valued at $17,000, and amounting to 476,780 pounds of lead, valued at $19,071. As this was purely an accessory product of the zinc works, requiring but the slightest plant beyond that in regular use, and accounted for under that industry, it was considered best to bring it in after the manner adopted, instead of placing it on the tables setting forth the regular lead industry. These small amounts wield comparatively no influence over the lead tables as presented.

ACCESSORY PRODUCTS OF THE LEAD-SMELTING WORKS.

The nickel and cobalt mattes are at present produced by three concerns in eastern Missouri, though such was not the case in the census year. This product has developed with the establishment of blast-furnaces, and will become permanent wherever the metals occur in the ore. The mattes are shipped from the United States containing from 15 to 20 per cent. of nickel and cobalt and 5 or 6 per cent. of copper. The product, white lead, has also developed within the past two or three years, and comes directly from the smelting operations in the Scotch hearth process, being manufactured from the lead fume given off in this process in combination with lead slag and carbonate ores. A portion, however, of the fume, called blue lead in distinction from the white lead, is sold direct to rubber-works. It is easily surmised from this that the other smelting-works will soon have a product additional to their pig-lead. Indeed, such is already the case, for 4,092,120 pounds of slag have been purchased from various parties, averaging from 25 to 40 per cent. lead, and valued at $9 50 per thousand pounds. The value of the products as given in the table might, therefore, be increased by $50,160, which figures will probably be exceeded another year.

The floating capital given is that usually employed, but it varies very greatly, according to the increase or decrease of the speculative desire. The fixed capital is, on the contrary, quite regular and steady, being the value of the land (surface only), furnaces, and machinery.

The percentages of capital employed in the various states are as follows:

Region.	Fixed.	Floating.	Total.
	Per cent.	*Per cent.*	*Per cent.*
Illinois	1.9	4.1	2.6
Iowa	1.7	2.3	1.9
Wisconsin	3.6	14.6	7.3
Kansas	1.6	6.9	3.4
Missouri	90.0	69.8	83.3
South and east of Ohio river	1.2	2.3	1.5
Total	100.0	100.0	100.0

In table No. 54 the statistics are also combined so as to show the work of the two great regions—the Upper Mississippi, comprising Wisconsin, Illinois, and Iowa, and the Lower, comprising Missouri and Kansas, and as well, also, that south and east of the Ohio river. The very slight extent of the operations of the Upper Mississippi, as compared with those of the Lower region, is to be noted. The former's percentage of the raw material worked up in the latter locality is only 15.2, the values not admitting of comparison on account of the fluctuation in the price of lead throughout the year. The percentage of the pig-lead product of the Upper Mississippi region to that of the Lower Mississippi is 14.1, but this is diminished if we take into consideration the accessory product of the latter, nickel and cobalt matte and white lead. Again, but 11.5 per cent. of the labor employed in the Lower Mississippi district is employed in the Upper, while 8.6 per cent. expresses the percentage of the days worked in the one, compared with the days worked in the other.

This superficial method of comparison is given merely to present a little more readily and forcibly the wide difference between the two localities, much changed from the condition of former times.

a

TABLE 54.—*Lead-smelting works.*

	SCOTCH HEARTH PROCESS.							
	Total.		Upper Mississippi region.		Lower Mississippi region.		South and East of Ohio River region.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
FURNACES.								
Mineral eyes	69		16		51		2	
Slag eyes	10		6		10		0	
MATERIALS.								
Fuel used in reducing ores, etc.:								
Coal.....pounds..	144,560	$181			144,560	$181		
Coke.....pounds..	2,394,000	14,878	122,800	$601	2,271,200	14,277		
Charcoal.....bushels..	130,591	10,806	3,992	456	116,599	9,850	10,000	$500
Wood.....cords..	2,895	6,919	701	3,335	1,238	3,011	956	573
Fuel used for power:								
Coal.....pounds..	8,795,422	8,584	19,000	43	8,776,422	8,541		
Wood.....cords..	395	676			376	638	19	38
Other supplies:								
Fluxes.....value..		2,705				2,705		
Finished materials.....value..		13,432		1,800		11,632		600
Total value of all supplies		58,181		6,235		50,235		1,711
Ores reduced:								
Total of all ores of each metal ..lbs..	58,542,034	1,610,629	7,900,972	213,504	48,639,062	1,369,822	1,912,000	27,303
LABOR.								
Skilled laborers.....No..	275		15		256		4	
Number of days employed	57,337		2,740		53,847		750	
Net wages		118,807		3,976		113,706		1,125
Ordinary laborers	120		28		87		5	
Number of days employed	20,487		5,842		19,595		1,050	
Net wages		38,005		7,015		29,940		1,050
Total wages		156,812		10,991		143,646		2,175
STAFF.								
Number of staff	15				15			
Salaries of same		18,540				18,540		
PRODUCTION.								
Pig-lead.....pounds..	43,590,785	2,014,904	5,061,151	261,395	36,991,766	1,718,069	886,868	35,500
Nickel and cobalt matte.....pounds..								
White lead.....pounds..	2,156,100	86,244			2,156,100	86,244		
Blue lead.....pounds..	348,489	12,197			348,489	12,197		
Total value of product		2,113,405		261,395		1,816,510		35,500
CAPITAL.								
Capital, fixed		395,295		46,245		339,050		10,000
Capital, floating		259,700		44,000		205,700		10,000

TABLE 54.—*Lead-smelting works*—Continued.

	AIR PROCESS.						BLAST PROCESS.		FLINTSHIRE PROCESS.	
	Total.		Upper Mississippi region.		Lower Mississippi region.		Lower Mississippi region.		Lower Mississippi region.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
FURNACES.										
Mineral eyes	22		9		13		3		3	
Slag eyes	1		1		0					
MATERIALS.										
Fuel used in reducing ores, etc.:										
Coal.....pounds							40,000	$102	2,201,840	$7,163
Coke.....pounds	78,000	$360	78,000	$360			4,067,600	14,331		
Charcoal.....bushels	100	12	100	12			18,000	1,080		
Wood.....cords	3,510	6,441	760	2,592	2,750	$3,849	5,366	10,730	1,790	3,581
Fuel used for power:										
Coal.....pounds									320,120	1,029
Wood.....cords	22	79	22	79			8,268	16,536	2,504	5,008
Other supplies:										
Fluxes.....value								15,740		1,548
Finished materials.....value		1,946		828		1,118		9,667		5,100
Total value of all supplies		8,888		3,871		4,967		68,186		23,420
Ores reduced:										
Total of all ores of each metal...lbs	9,941,507	248,394	4,107,923	108,659	5,833,584	139,735	18,072,530	316,785	7,162,000	138,226
LABOR.										
Skilled laborers.....No	33		17		16		68		13	
Number of days employed	5,373		2,335		3,038		18,286		4,162	
Net wages		11,683		5,933		5,750		26,722		7,649
Ordinary laborers	28		14		14		156		33	
Number of days employed	5,579		2,213		3,366		40,950		10,296	
Net wages		7,920		3,090		4,830		50,006		13,626
Total wages		19,603		9,023		10,580		76,728		21,275
STAFF.										
Number of staff							10		2	
Salaries of same								13,928		5,000
PRODUCTION.										
Pig-lead.....pounds	6,537,319	310,446	2,520,888	122,116	4,016,431	188,330	12,473,514	695,000	3,943,440	157,926
Nickel and cobalt matte.....pounds							98,293	5,514		
White lead.....pounds										
Blue lead.....pounds										
Total value of product		310,446		122,116		188,330		700,613		157,926
CAPITAL.										
Capital, fixed		31,572		17,065		14,507		328,482		120,000
Capital, floating		75,545		47,300		28,245		75,000		25,000

a In explanation of many of the details of this table reference may be had to the remarks on Table 53. It is to be noticed, however, that the number of furnaces is substituted for establishments, as showing the extent of the plant in use in turning out the product. The figures of the subdivision "mineral eye" are intended to represent the furnaces engaged in smelting mineral, while the figures of the second subdivision represent the extent of plant engaged in working up the residues and slag resulting from the first treatment of mineral. The process by the Scotch hearth is nearly the only one employing this secondary treatment, since it can be done with no appreciable additional outlay for machinery, the requisite power and blast being obtained from the same source as the first treatment. On the other hand, the air-reduction process would require not only a greater outlay for a proper furnace than the other, but also power and blower; consequently, since the secondary treatment is generally not b considered profitable by the smelters using this process, the slag of these furnaces is usually thrown aside, and, if opportunity offers, is sold. Associated with the blast-furnaces, as an essential part of the plant, are one nickel furnace, one improving furnace, and eight roasting furnaces.(a)

Regarding the supplies consumed, the arrangement in this table gives a better idea of their distribution than that of the preceding table, and it is in part explanatory of the varying amounts consumed in three regions as well as in separate states, as shown in the first table.

The percentages of ore worked up by the various processes are, for the—

c

Process.	Per cent.
Scotch hearth	62.47
Air-furnaces	10.61
Blast	19.28
Flintshire	7.64
Total	100.00

Of the ores worked by the first process, 83.08 per cent. was smelted in the Lower Mississippi region, while but 13.65 per cent. was smelted in the Upper, the remaining 3.27 per cent. being that worked in the east. This illustrates very well the relative magnitude of this process in the three regions. The work of the air-furnaces is more equally divided between the two western regions, the percentage of ore consumed being, for the Upper Mississippi region 41.32 per cent., and for the Lower Mississippi region 58.68 per cent.

The average day's wages earned in the different processes in the various districts by skilled and by unskilled d labor are as follows:

e

Process.	Locality.	WAGES PER DAY.	
		Skilled labor.	Ordinary labor.
Scotch hearth	Upper Mississippi	$1 45	$1 20
	Lower Mississippi	2 11	1 53
	South and East of Ohio river	1 50	1 00
	Average	2 07	1 43
Air-furnace	Upper Mississippi	2 52	1 39
	Lower Mississippi	1 89	1 43
	Average	2 17	1 42
Blast	Lower Mississippi	1 46	1 22
Flintshire	Lower Mississippi	1 84	1 32

The fact that the labor of the air-furnaces is paid more than that of the Scotch hearth is due to the location, the Scotch hearths being located in the region of low wages, and the air process in the region of high wages, as previously mentioned, under the discussion of Table 53. That the skilled labor of the blast-furnaces is as low as the figures represent is due to the fact that it is not of as high a standard as that of the first two processes, for here f superintendence is more strict, larger salaries being paid for metallurgists and managers, whose duty is the immediate supervision of the operations and the laborers conducting them. The labor of the Flintshire process, on the contrary, is of a higher type than that of the blast-furnace, and more nearly approaches the labor of the other processes.

The percentage of total yield we find to be distributed thus:

Process.	Percentage.
Scotch hearth	65.5
Air-furnaces	9.8
Blast	18.8
Flintshire	5.9
Total	100.0

a From the data derived from the mining schedules of the parties owning the furnaces, it seemed proper that the Eastern works should be included among the Scotch hearths.

In addition to this, there must be taken into account the white-lead production of the Scotch hearths, and a the matte production of the blast-furnaces.

The percentages of capital employed in the processes are, for the—

Process.	Percentage.
Scotch hearth	50.0
Air-furnaces	8.2
Blast	30.7
Flintshire	11.1

These are the leading peculiarities of this table. b

TABLE 55.—*To produce one ton of lead, by states and regions.*

States.	Value of fuel.	Value of other supplies.	Total value of all supplies.	Ore used.	Total number of days.	Total wages paid, including staff.	Total capital.
				Pounds.			
Illinois	$1 20	$0 53	$1 73	2,915.07	2.75	$3 57	$40 57
Iowa	1 44	88	2 32	2,851.62	3.29	4 17	36 30
Wisconsin	2 14	61	2 75	3,000.36	3.34	5 53	37 28
Total Upper Mississippi region	1 83	64	2 47	2,957.44	3.21	4 89	37 79
Kansas	1 16	81	1 97	2,882.97	2.61	6 54	13 93
Missouri	3 77	1 74	5 51	2,762.66	5.08	10 53	42 76
Total Lower Mississippi region	3 48	1 63	5 11	2,771.17	5.34	10 08	39 49
South and East of Ohio River region	2 51	1 35	3 86	4,316.03	4.06	4 91	45 15
Aggregate	3 26	1 51	4 77	2,818.84	5.07	9 38	39 42

c

To produce one ton of lead, by regions and processes.

d

Process.	Region.	Value of fuel.	Value of other supplies.	Total value of all supplies.	Ore used.	Total number of days.	Total wages paid, including staff.	Total capital.
					Pounds.			
Scotch hearth	Upper Mississippi	$1 57	$0 63	$2 20	2,822.67	3.03	$3 88	$31 88
Do	Lower Mississippi	1 07	74	2 71	2,629.71	3.97	8 77	29 45
Do	South and east of Ohio river	2 51	1 35	3 86	4,316.03	4.06	4 91	45 15
	Total all regions	1 93	74	2 67	2,689.12	3.85	8 15	30 09
Air	Upper Mississippi	2 41	66	3 07	3,260.27	3.61	7 16	51 08
Do	Lower Mississippi	1 92	55	2 47	2,905.17	3.18	5 27	21 29
	Total all regions	2 11	59	2 70	3,041.15	3.35	6 00	32 77
Blast	Lower Mississippi	6 86	4 07	10 93	2,807.03	9.50	14 54	64 69
Flintshire	do	8 51	3 37	11 88	3,631.85	7.33	13 32	79 53

This table shows the relative efficiency of work in the states, regions, and processes. It is computed from data furnished by the preceding tables, the basis of calculation being the ton of product. As it is intended to show the cost of production exclusive of the value of the ore, values of the materials, etc., are given in preference to quantities. f *One or two points require slight explanation. As in the preceding tables, the values are at the furnace, therefore* care must be exercised in considering the contents and studying the varying conditions. Referring to the pounds of ore required to produce 1 ton of lead, the difference in the figures of this column in the same process are not only due to skill in working, but very largely to the degree to which the ore is dressed, some smelters using ore much more free from dirt, clay, and "tiff" than others.

In Missouri the low figures of the ore consumed are due to the Scotch-hearth process, while the high figures for supplies and labor are traceable to the blast and Flintshire furnaces, their ore from its nature requiring dressing from 6 per cent. up to 70 per cent. or more, roasting and fluxing. But they turn out an immense product, capable of being produced from the raw material (rock carrying 6 per cent. galena) in no other manner. Consequently, while more expensive than other processes, there are advantages accruing outbalancing the disadvantages.

a TABLE 56.—*Relation of product to lead ores consumed, by states.*

Region.	Ores reduced.	Lead obtained from same.	Per cent. obtained.
	Pounds.	*Pounds.*	
Illinois	2,457,404	1,685,797	68.6
Iowa	1,987,582	1,394,824	70.2
Wisconsin	7,653,909	5,101,418	66.6
Total	12,098,895	8,182,039	67.6
b			
Kansas	9,176,500	6,365,551	69.3
Missouri	70,530,676	51,059,060	72.4
Total	79,707,176	57,425,151	72.0
South and East of Ohio River region	1,912,000	886,868	46.4
Aggregate	93,718,071	66,494,058	71.0

c *Relation of product to lead ores consumed, by regions and processes.*

Process.	Region.	Ores reduced.	Lead obtained from same.	Per cent. obtained.
		Pounds.	*Pounds.*	
Scotch hearth	Upper Mississippi	7,990,972	5,661,151	70.8
Do.	Lower Mississippi	48,639,062	36,991,766	76.1
Do.	South and East of Ohio river	1,912,000	886,868	46.4
	Total	58,542,034	43,539,785	74.4
Air	Upper Mississippi	4,107,923	2,520,888	61.4
d Do.	Lower Mississippi	5,833,584	4,016,431	68.8
	Total	9,941,507	6,537,319	65.9
Blast	Lower Mississippi	18,072,530	12,473,514	69.0
Flintshire	do	7,162,000	3,943,440	55.1

This table represents the average working results of the treatment of ores. While it is impossible to assert that the product was the actual outcome of the ores appearing in the other column, owing to the difficulty attending the separation of one year's work from another, the results are nevertheless very close, and furnish another means of comparison under the varying conditions of locality and process.

e TABLE 57.—*Machinery employed in the reduction of lead ores, by states.*

Region.	Horse-power of engines.	Engines.	Boilers.	Water-wheels.	Pumps.	Crushers.	Rolls.	Screens.	Jigs.	Other machines.	Blowers.	Total value of all machinery.
		Number.	*Number*	*Number.*	*Number*	*Number.*	*Number.*	*Number.*	*Number*	*Number.*	*Number.*	
Illinois	.....	.....	.....	4	.....	.....	.....	.....	.....	.....	4	$1,500
Iowa	20	2	2	3	.....	.....	.....	.....	.....	.....	4	2,775
Wisconsin	.....	.....	.....	6	.....	.....	.....	.....	.....	.....	6	1,925
Total Upper Mississippi region	20	2	2	13	.....	.....	.....	.....	.....	.....	14	6,200
Kansas	45	1	1	.....	1	.....	.....	.....	.....	3	1	2,300
Missouri	685	50	35	5	32	13	21	27	104	26	20	237,435
Total Lower Mississippi region	730	51	36	5	33	13	21	27	104	29	21	239,735
South and East of Ohio River region	8	1	1	4	3	.....	4	.....	6	.....	2	3,700
Aggregate	758	54	39	22	36	13	25	27	110	29	37	a249,035

a This total includes 5 portable engines.

TABLE 57.—*Machinery employed in the reduction of lead ores, by regions and processes*—Continued.

Process.	Region.	Horse-power of engines.	Engines.	Boilers.	Water-wheels.	Pumps.	Crushers.	Rolls.	Screens.	Jigs.	Other machines.	Blowers.	Total value of all machinery.
			Number.	*Number*	*Number.*	*Number*	*Number.*	*Number.*	*Number.*	*Number*	*Number.*	*Number.*	
Scotch hearth..	Upper Mississippi	20	2	2	13	.....	.....	.....	.....	.....	.....	14	$6,200
Do.....	Lower Mississippi	345	12	13	5	6	5	4	4	22	6	17	39,460
Do.....	South and East of Ohio river..	8	1	1	4	3	.....	4	.....	6	.....	2	3,700
Total	.....	373	15	16	22	9	5	8	4	28	6	33	49,360
Air	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Blast	Lower Mississippi	185	35	14	.....	20	5	9	11	52	18	4	150,275
Flintshire	... do.....	200	4	9	.....	7	3	8	12	30	5	.....	50,000

TABLE 58.—*Comparative view of lead industry for the years* 1850, 1860, 1870, *and* 1880.

Year.	Total number of establishments.	Value of material.	Amount of ore smelted.	Number of hands.	Wages.	Product pig-lead.	Value of all product.	Capital.
1850.....	150	$1,532,585	.....	753	$181,750	....	$2,150,008	$603,196
1860.....	23	724,297	.....	104	45,084	.....	839,222	218,922
1870.....	62	2,807,074	104,580,000	589	237,628	43,030,000	3,499,183	2,199,600
1880.....	57	2,465,610	93,718,071	726	274,418	*66,494,058	3,282,300	1,310,594

*See note, page 814.

THE ZINC INDUSTRY.

TABLE 59.—*Zinc-smelting works.*

	TOTAL.		EASTERN WORKS.		ILLINOIS.		KANSAS.		MISSOURI.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Number of counties.....	9	.....	4	.....	2	.....	2	.....	1	.....
Number of establishments.....	13	.....	4	.....	4	.....	2	.....	3	.....
MATERIALS.										
Fuel used in reducing ores, etc.:										
Anthracite coal .....pounds..	20,142,119	$25,312	.....	.....	20,142,119	$25,312	.....	.....	.....	.....
Bituminous coal.....pounds..	276,233,286	193,261	34,413,046	$34,413	159,036,240	101,230	29,282,000	$13,022	53,502,000	$43,687
Coke .....pounds..	8,102,000	4,427	.....	.....	400,000	300	2,522,000	4,037	180,000	90
Charcoal .....bushels..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wood .....cords..	442	1,326	.....	.....	442	1,326	.....	.....	.....	.....
Fuel used for power:										
Coal..... .....pounds..	20,557,773	14,235	2,237,084	2,237	15,286,689	9,508	1,256,000	577	1,778,000	1,913
Wood .....cords..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Other supplies:										
Fluxes.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Finished materials.....	.....	64,462	.....	11,000	.....	38,694	.....	6,825	.....	7,943
Total value of all supplies	.....	303,023	.....	47,650	.....	176,379	.....	25,361	.....	53,633
Ores reduced:										
Galena .....pounds..	680,000	17,000	.....	.....	680,000	17,000	.....	.....	.....	.....
Blende .....pounds..	77,797,302	770,185	13,932,837	69,660	45,000,177	528,620	12,517,463	117,435	5,446,915	54,470
Silicate of zinc .....pounds..	43,380,691	379,116	8,305,300	61,165	11,916,121	86,602	.....	.....	23,159,270	231,349
Carbonate of zinc .....pounds..	6,188,060	35,333	.....	.....	548,060	4,313	.....	.....	5,640,000	31,020
Total of all ores of each metal ....pounds..	128,046,143	1,201,634	22,238,137	130,825	59,044,358	636,535	12,517,463	117,435	34,246,185	316,839
Additional ores of zinc whose product was oxide of zinc.....pounds..	100,678,343	503,392	100,678,343	503,392	.....	.....	.....	.....	.....	.....
LABOR.										
Skilled laborers.....No..	550	.....	80	.....	216	.....	82	.....	172	.....
Days employed .....No..	179,135	.....	29,054	.....	78,385	.....	22,226	.....	49,470	.....
Net wages	.....	333,538	.....	47,988	.....	120,468	.....	44,173	.....	111,009
Ordinary laborers.....No..	395	.....	89	.....	238	.....	36	.....	32	.....
Days employed .....No..	128,078	.....	30,048	.....	81,032	.....	10,245	.....	7,073	.....
Net wages	.....	177,449	.....	40,144	.....	168,303	.....	15,719	.....	13,283
Total wages	.....	510,987	.....	88,132	.....	237,771	.....	59,892	.....	125,192
STAFF.										
Number	27	.....	4	.....	18	.....	5	.....	.....	.....
Salaries.....	.....	29,683	.....	6,000	.....	20,368	.....	3,315	.....	.....

a TABLE 59.—*Zinc-smelting works*—Continued.

	TOTAL.		EASTERN WORKS.		ILLINOIS.		KANSAS.		MISSOURI.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
PRODUCTION.										
Pig-lead.....pounds..	476,780	$19,071	.....	.....	476,780	$19,071	.....	.....	.....	.....
Spelter.....pounds..	46,477,999	2,862,712	8,426,831	$725,679	21,807,038	1,243,001	4,902,953	$279,468	11,341,177	$614,564
Zinc oxide.....pounds..	20,213,631	763,738	20,213,631	763,738	.....	.....	.....	.....	.....	.....
Total value of product.....	.....	3,645,521	.....	725,679	.....	1,262,072	.....	279,468	.....	614,564
CAPITAL.										
Capital, fixed.....	.....	811,200	.....	125,000	.....	395,200	.....	96,000	.....	195,000
Capital, floating.....	.....	380,120	.....	67,120	.....	198,000	.....	60,000	.....	55,000

Table 59 represents the statistics for the different regions in which the zinc industry is pursued.

The number of establishments embraces only those engaged in the production of spelter, and in the east it should be observed that while the figures for the product and the ores consumed are deemed reliable, authentic data for the supplies, etc., were so sparse, owing to an inevitable omission of personal visits, that their figures must not be accepted with the same degree of confidence as those of the remaining localities.

c Regarding the derivation of coal, excluding the anthracite screenings which are usually purchased from coal-dealers in the large cities, we find from the schedules that supplies were obtained as follows:

Region.	Supply.	Per cent.
	Pounds.	
Lower Illinois (the Big Muddy field).....	55,280,000	18.6
Upper Illinois	174,322,929	58.7
Kansas	30,538,000	10.3
Eastern fields.....	36,650,130	12.4
Total	296,791,059	100.0

d at the prices, respectively, of $1 63, $1 27, $0 95, and $2 per ton at the works. The Missouri works used Illinois coal mined from 12 to 40 miles distant, the eastern works coal mined at various distances, the remaining works coal mined in close proximity. The processes pursued in Illinois in smelting the majority of the ores, had, on account of the regenerative furnaces used, a marked influence upon the amount of coal consumed.

The coke used in Illinois and Missouri came from Saint Louis, being an inferior quality of gas-coke. That used in Kansas was made in the vicinity of the works, and was of a quality greatly superior to the former.

The derivation of the ores of zinc is noted further on. Of the total ores of zinc of which the product was spelter, namely 127,366,143 pounds, those smelted in eastern works form 17.5 per cent., those in Illinois 45.8 per cent., those in Kansas 9.8 per cent., and those in Missouri 26.9 per cent.

e *Values of zinc ores.*—The price given is nominally based upon the market price of spelter in New York; but in reality, owing to the immense size of a few establishments, it is entirely controlled by them. This is easily done on account of an additional product turned out, namely-rolled or sheet zinc.

Zinc ores consumed.—The disagreement between the ore returns of the mining and the smelting industries appears at first sight enormous, but it can be entirely accounted for. As the simplest and most expeditious mode of explaining it, we present it in a somewhat summarized form, thus: From the smelting schedules, deducting 680,000 pounds for lead ore given in the total ores of zinc-works, we have—

	Pounds.
Total zinc ores smelted (of which the product was spelter)	127,366,143
Total zinc ores smelted (of which the product was oxide of zinc)	100,678,343
Total zinc ores smelted.....	228,044,486
f Zinc ores purchased and at works (but not smelted)	2,435,965
Total ores of zinc shown on smelting schedules	230,480,451
Eastern ores per mining schedule	148,318,000
Western ores per mining schedule	98,418,000
Total shown on mining schedules, as mined	246,736,000
Total shown on smelting schedules, as mined	230,480,451
Difference in favor of mining schedules, to be accounted for.....	16,255,549

Or 7.9 per cent. expressed in a percentage of smelter's returns. For the full understanding of this discrepancy the composition of the figures given above must be considered. For this purpose we have used the terms

"Western" and "Eastern", the Western division comprising the southwest region of Missouri and Kansas, and a the northwest one of Illinois and Wisconsin, the Eastern division comprising all the works east of the Appalachian mountains. It may be observed in this connection that the ores mined in the above divisions are smelted by the works in their respective divisions and not transferred from one to the other, except in the case of Tennessee, a portion of whose ores goes to the Western and a portion to the Eastern division. With this understanding, and bearing in mind that we are dealing in a case of smelter's returns, with the total ores that have reached their hands, whether smelted or not, we first notice the total ores of the west, which are again immediately afterward presented in the two sections of the southwest and northwest for more conclusively tracing any difference of returns appearing in this division.

WESTERN DIVISION.

b

	Pounds.
Total ores appearing on smelter's schedules, as mined and purchased, including ores reduced to oxide of zinc in the west	110,291,971
Total ores mined, as per mining schedules	98,418,000
Excess of ore per smelting returns over ore per mining returns	11,873,971

Or 10 per cent. of the ore appearing on the smelter's schedules, traceable thus:

Tennessee ores mined and smelted, balance each other.

	Pounds.
Ores mined in southwest district, as per mining schedules	83,194,000
Ores mined and purchased in same district, as per smelting schedules	84,172,951
Excess of ore per southwest smelting schedules over ore per mining schedules	978,951

c

Equivalent to 1.1 per cent. of smelter's returns, much within a legitimate variation.

	Pounds.
Ores mined in northwest district per mining schedules	15,234,000
Ores mined and purchased in same district per smelting schedules	25,637,020
Excess of northwest ore per smelting returns over ore per mining returns	10,403,020

Equivalent to 40.6 per cent. of smelter's returns. A large difference, but to be explained in the same manner as was the large difference between the lead returns of the same region.

EASTERN DIVISION.

d

Previous to presenting the figures relating to the work in the Eastern region, it should be remarked that the figures representing the ores consumed in the manufacture of spelter are deemed correct. In the case of ores yielding oxide of zinc, the figures are drawn from several sources, such as, 1st, the returns of the ores by the manufacturers; 2d, the returns on the mining schedules that can be traced to their actual destination.

	Pounds.
Total ores appearing on mining schedules of the east	148,318,000
Totals ores smelted appearing on smelting returns	120,188,480
Excess of ore on mining returns over ore on smelting returns	28,129,520

Or 23 per cent. of the smelted ores. Upon investigation of the mining schedules this entire amount from eastern e mines was found not to have been smelted, nor to have found its way into the hands of the smelter. It is due to various legitimate causes, the chief being the want of preparation by mining companies to reduce their own ores, and a consequent accumulation thereof until late in the year, their mines being worked during the entire year.

By the following scheme the discrepancy will be seen to be thus distributed:

	Pounds.
For the entire country, ore by mine returns exceeds ore by smelter's returns by	16,255,549
For the Western division, ore by mine returns less than ore by smelter's returns by	11,873,971
For the Eastern division, ore by mine returns exceeds ore by smelter's returns by	28,129,520

The excess of zinc ore on mine returns of the east not only balances the deficiency of zinc ores on mine returns of the west, as compared with smelter's returns, but leaves an excess of zinc ore on mine returns for the entire f country of 16,255,549 pounds.

TABLE 60.—*Percentages of metal obtained from the ores, by regions.*

Region.	Ores reduced.	Blende.	Silicate.	Carbonate.	Product obtained.	Metal obtained.
	Tons.	*Per cent.*	*Per cent.*	*Per cent.*	*Tons.*	*Per cent.*
Eastern works	22,238,137	62.7	37.3	.....	8,426,831	37.9
Illinois	58,364,358	78.7	20.4	0.9	21,807,038	37.4
Kansas	12,517,463	100.0	.....	.....	4,002,953	30.2
Missouri	34,246,185	16.0	67.6	16.4	11,341,177	33.1
Total	127,366,143	61.1	34.1	4.8	46,477,999	36.5

a The following represents the percentages of the total product obtained in each locality.

Region.	Per cent.
Eastern works	18.1⅛
Illinois, La Salle and Peru regions, and one small concern in South Illinois.	46.9
Kansas (eastern part)	10.5⅛
Missouri (Saint Louis)	24.4
Total	100.0

b A small amount of lead from mineral coming in with their zinc ores was produced by one establishment in Illinois. This was obtained in part direct, and in part by dressing machinery, and is accounted for both in the note under the lead industry (p. 814), and in the table of grand totals, No. 53.

TABLE 61.—*Average cost of materials, labor, etc., per ton of metal produced.*

c

Region.	Value of fuel.	Value of other supplies.	Total value of all supplies.	Pounds of ore used.	Total number of days.	Total wages, including staff.	Total capital.	Tons of product.
Eastern works	$8 69	$2 61	$11 30	5,277.94	14.02	$22 34	$45 59	1
Illinois	12 62	3 55	16 17	5,415.17	13.70	23 67	54 40	1
Kansas	7 56	2 78	10 34	5,106.10	13.24	25 78	63 63	1
Missouri	8 05	1 40	9 45	6,030.26	10.07	22 08	44 00	1
Total	10 26	2 77	13 03	5,509.97	13.26	23 26	51 26	1

The percentage of capital employed in the various states is as follows:

d

Region.	Fixed.	Floating.	Total.
Eastern works	15.4¼	17.0⅜	16.1⅛
Illinois	48.7¼	52.0⅜	49.8
Kansas	11.8¼	15.7⅜	13.1
Missouri	24.0¼	14.4⅜	20.9⅛
Total	100.0	100.0	100.0

The high percentage of the capital employed in Illinois might mainly be assigned to two large works. The fixed capital conveys an excellent idea of the extent of the plant.

TABLE 62.—*Representation of the furnace plant of the zinc smelters of the western states.*

Region.	Number of Belgian furnaces.	Number of retorts in each.	Number of Siemens furnaces.	Number of retorts in each.	Number of M. and H. patent furnaces.	Number of retorts in each.	Total number of retorts.	Total daily capacity in pounds of roasted ore.	Number of reverberatory roasting-furnaces.	Number of roasting-kilns.
Illinois	25	From 50 to 127.	3	1 of 192, 2 of 284.	4	2 of 360, 2 of 288.	4,188	205,200	21	5
Kansas	8	4 of 98, 4 of 106.	0	.....	0	.....	816	30,000	18	0
Missouri	26	90 to 180	0	.....	0	.....	2,628	139,500	5	5
Total	59	.....	3	.....	4	.....	7,632	384,300	44	10

NOTE.—Of the roasting-furnaces 2 are gas, 2 hot-air, 16 ordinary, of from 2 to 4 hearths, 1 automatic.

This table is representative of the furnace plant of the zinc smelters of the western states, that of the eastern not having been obtained, owing to the nonvisiting of their works and the impossibility of getting satisfactory results from letters alone. In giving the number of furnaces, single furnaces and not blocks are understood. But, of the extent of plant, the best idea can be gathered from the number of retorts, the average daily charge of

f roasted ore per retort being 50 pounds. The roasting-furnaces are usually of two or three hearths, and are calculated to keep even in their work with the demands of the Belgian furnaces. In addition to this plant, there are drying-kilns for retorts, condensers, and tiles, all of which are made at the works and included under finished materials in Table No. 59.

TABLE 63.—*Mechanical plant employed in the reduction of zinc ores.*

Region.	Horse-power of engines.	Engines.	Boilers.	Water-wheels.	Pumps.	Crushers.	Rolls.	Screens.	Jigs.	Other machines.	Blowers.	Total value of machinery.
Illinois	320	9	13	1	9	3	14	12	7	23	2	$40,774
Kansas	100	3	2	.....	3	.....	8	5	.....	5	.....	6,925
Missouri	153	5	4	.....	3	.....	8	3	2	8	.....	10,770
Total	573	17	19	1	15	3	30	20	9	36	2	58,469

The labor of the zinc establishments is much more capable of a proper division into "skilled" and "ordinary" a labor than that of the lead-works. The line of demarkation is quite sharp, being usually drawn between the "long-shift men" and the "half-shifts" among the furnacemen, and including, as in other cases, mechanics among the "skilled" workmen, and yard hands, etc., among the ordinary.

The following are the day's wages obtained in the different localities:

Localities.	Skilled labor.	Ordinary labor.
Eastern works	$1 65	$1 33
Illinois	1 65	1 33
Kansas	1 98	1 53
Missouri	2 26	1 74
Total	1 86	1 37

b

The skilled labor is by no means all of one class, but the daily wages paid range from $1 75 to $2 75. This labor is also mostly foreign, consisting largely of Belgians coming to this country both at the instigation of the zinc smelters and of their own accord.

THE COPPER INDUSTRY.

TABLE 64.—*Copper-smelting works.* c

	EASTERN WORKS.		WESTERN WORKS.		TOTAL.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Number of establishments	6		2		8	
MATERIALS.						
Fuel used in reducing ores:						
Coal ....pounds..	15,488,000	$28,026	32,141,867	$59,077	47,629,867	$87,703
Coke ....pounds..	524,000	1,585	486,000	1,498	1,010,000	3,083
Charcoal ....bushels..	1,815,000	131,500	46,022	6,260	1,861,022	137,760
Wood ....cords..	13,100	29,135	10	40	13,110	29,175
Wood ....poles..	5,500	1,833	25,500	8,500	31,000	10,333
Fuel used for power:						
Coal ....pounds..	4,900,000	7,268	4,520,400	8,335	9,420,400	15,603
Wood ....cords..	1,460	3,576			1,460	3,576
Other supplies:						
Fluxes ....value..		2,000		5,520		7,520
Finished materials ....value..		10,000		23,553		33,553
Total value of all supplies		215,523		112,783		328,306
Ores reduced:						
Native copper....pounds..			58,361,070	5,842,909	58,361,070	5,842,909
Other ores of copper....pounds..	66,699,023	652,801			66,699,023	652,801
Nickeliferous pyrrhotite ....pounds..	14,850,000	150,000			14,850,000	150,000
Total of all ores of each metal....pounds..	81,549,023	802,801	58,361,070	5,842,909	139,910,093	6,645,710
Metals refined:						
Copper matte refined ....pounds..	12,528,779				12,528,779	
LABOR.						
Skilled laborers....No..	176		101		277	
Number of days made by same	39,384		30,656		70,040	
Net wages of same		85,888		88,173		174,061
Ordinary laborers ....No..	228		135		363	
Number of days made by same	53,429		35,638		89,067	
Net wages of same		71,124		65,427		136,551
Total wages		157,012		153,600		310,612
Staff:						
Number of staff	15		15		30	
Total salaries of same		15,000		26,600		41,600
PRODUCTION.						
Nickel and cobalt....pounds..	310,117	310,117			310,117	310,117
Ingot copper ....pounds..	9,041,884	1,591,571	45,130,133	7,870,682	54,172,017	9,462,253
Blue vitriol (sulphate of copper)....m....pounds..	533,786	37,365			533,786	37,365
Total value of product		1,939,053		7,870,682		9,809,735
CAPITAL.						
Capital, fixed		575,500		468,000		1,043,500
Capital, floating		309,000		210,000		519,000

a Table No. 64 needs no lengthy comment.

The supply of coal for the copper industry of the lake region is drawn from Ohio, in connection with Pennsylvania, but it is impossible to give the relative quantities coming from each. That used in the eastern works is from eastern fields.

Pennsylvania supplies the entire demand for coke.

The ores of copper smelted in the eastern works are brought up to the large weight indicated, from the fact that the quantities reported are from ores as they entered the furnace, some of them containing but 4 per cent. of copper. This must be borne in mind when considering their amount in connection with that from the Lake Superior region, which was altogether native copper.

b The figures marked nickeliferous pyrrhotite are those for the ores of nickel yielding copper as an accessory product. They were placed with the copper, as they contained a slight amount of this metal, but from their difference in character, it was not thought best to combine the two under the same name.

The great difference between the returns of copper ore consumed by the smelters and that returned under mining, is due to the fact that the figures of mining schedules represent rock, whereas those of the smelters represent the mineral and ore as ready for the smelters' treatment.

In the product, the accessory portion of blue vitriol (sulphate of copper) is from the nickel ores.

The entire product of ingot copper during the census year was 54,172,017 pounds. In the preliminary bulletin issued upon copper, the product of the extreme western states and territories, Colorado, Arizona, Idaho, California, c Alaska, Montana, Nevada, and New Mexico, is given as 5,410,546 pounds, based entirely upon the assay value of the ore in copper. This would make the total mining returns 56,320,266 pounds, being 2,147,249 pounds in excess of the figures as returned by smelters, a difference of about 4 per cent. expressed in the percentage of the smelters' product. This discrepancy was to be expected. The returns from the extreme west are based on the assay value of the ore at the mines. The mines and the smelting-works being in some cases remote from each other, the statements of ingot-copper product for the mines and of ingot-copper product at the smelters would hardly agree at the close of the census year, even if, in a final settlement of accounts, their statements were harmonious. Another element of discrepancy between the product as returned from mines and that returned from smelting works, lies in the export of ore mined and the use of imported ore by smelters (see table).

d TABLE 65.—*Leading statistics of materials, etc., based upon a product of* 1 *ton of copper.*

Region.	Value of fuel.	Value of other supplies.	Total value of all supplies.	Pounds of ore used.	Total number of days.	Total wages, including staff.	Total capital.	Tons of product.
Eastern works	$45 02	$2 05	$47 07	14,753.35	20.54	$38 04	$195 64	1
Western works	3 71	1 28	4 99	2,580.34	2.94	7 04	30 04	1
Total	10 60	1 52	12 12	4,617.15	5.88	13 00	57 66	1

TABLE 66.—*Smelting and refining works east of* 100*th meridian.*

e

	UNITED STATES.	
	Quantity.	Value.
Number of establishments	5	
MATERIALS.		
Fuel used in reducing ores, etc.:		
Coal ..... pounds..	48,323,041	$76,716
Coke ..... pounds..	21,437,071	71,619
Charcoal ..... bushels..	1,700	102
Wood ..... cords..	40	200
Fuel used for power:		
Coal ..... pounds..	18,452,800	33,983
Other supplies:		
Fluxes	.....	12,660
Spelter ..... pounds..	8,089,552	383,888
Finished materials	.....	34,324
Total value of all supplies	.....	613,492
Ores reduced:		
Galena ..... pounds..	1,201,519	12,180
Gold and silver ores ..... pounds..	18,185,846	a 1,318,545
Contents in gold, 6,020 ounces; silver, 1,210,596 ounces; lead, 2,611,988 pounds.		
Total of all ores of each metal. pounds..	19,387,365	a 1,330,725
Metals refined:		
Base bullion ..... pounds..	99,663,460	.....
Copper matte, refined ..... pounds..	79,839	.....

	UNITED STATES.	
	Quantity.	Value.
LABOR.		
Skilled laborers ..... No..	179	.....
Days employed	60,652	.....
Net wages	.....	$138,344
Ordinary laborers ..... No..	516	.....
Days employed	160,087	.....
Net wages	.....	273,679
Total wages	.....	412,023
Staff:		
Number	37	.....
Total salaries	.....	70,734
PRODUCTION.		
Pig-lead ..... pounds..	95,967,207	4,737,634
Sulphate of copper or blue vitriol ..... pounds..	100,000	6,000
Gold ..... ounces..	48,891	1,010,570
Silver ..... ounces..	13,226,444	14,882,060
Total value of product	.....	20,636,264
CAPITAL.		
Capital, fixed	.....	606,750
Capital, floating	.....	896,250

a Estimated in part.

Table 66 would be best discussed from the metallurgical side. Statistically, it cannot be discussed except as a a whole, as there enter into its composition the figures derived from many different steps in the process of extraction of the product, each of which is varying from one day to another, in accordance with the raw or partially raw material to be refined. It may, however, be noted, first, that the sources of the coal consumed are as follows:

Region.	Consumption.	Per cent.
	Pounds.	
Illinois	11,975,000	17.93
Pennsylvania	25,517,030	38.21
Iowa	29,283,811	43.86
Total	66,775,841	100.00

b

The source of coke is Pennsylvania, with the exception of 4,735,000 pounds, which came from the Carbondale field of Illinois. The spelter is the amount purchased and employed during the census year, as nearly as can be obtained. It is, of course, used more than once, which fact hinders us from getting at the exact amount consumed, though the purchasers from year to year are supposed to represent it pretty closely.

The ores are from the west, with the exception of the galena, and 84,159 pounds of argentiferous ore from Missouri and Arkansas, containing 2,936.37 ounces of silver.

As to the base bullion refined and product given in this table, there should be added to these figures those of c the western works, the resulting figures then representing the entire consumption of base bullion by, and the product of, the precious-metal smelting- and refining-works. These figures are from data furnished in the *Report of the Precious Metal Statistics* by Mr. King, and are for: Base bullion refined, 2,722,445 pounds (estimated), yielding 2,586,370 pounds refined pig-lead, having a value of $122,853; about 423 ounces of gold, valued at $8,743 41; and a probable 136,728 ounces of silver, of a market value of $153,819; thus increasing the corresponding figures of this table for the base bullion treated to 102,385,905 pounds; the refined lead to 98,553,637 pounds, of a total value of $4,860,487; the gold to 49,314 ounces, of a value of $1,019,313; the silver to 13,363,172 ounces, at the market value of $15,035,879.

TABLE 67.—*Grand total of smelting-works.*

	UNITED STATES, EAST OF THE 100TH MERIDIAN.			UNITED STATES, EAST OF THE 100TH MERIDIAN.	
	Quantity.	Value.		Quantity.	Value.
Number of establishments	83		MATERIALS—continued.		
MATERIALS.			Metals refined:		
Fuel used in reducing ores, etc.:			Base bullion refined ..... pounds..	99,663,460	
Coal ..... pounds..	394,804,713	$390,438	Copper matte refined ..... pounds..	12,608,618	
Coke ..... pounds..	92,088,731	108,698	LABOR.		
Charcoal ..... bushels..	1,511,413	149,760	Skilled laborers ..... number..	1,395	
Wood ..... cords..	27,153	58,372	Number of days employed	394,985	
Wood ..... poles..	31,000	10,333	Net wages		$310,804
Fuel used for power:			Ordinary laborers	1,011	
Coal ..... pounds..	57,555,515	73,434	Number of days employed	461,444	
Wood ..... cords..	12,649	25,875	Net wages		697,236
Other supplies:			Total wages		1,508,040
Fluxes ..... value..		40,173	Staff:		
Spelter ..... pounds..	8,089,552	383,888	Number of staff	121	
Finished materials ..... value..		162,484	Total salaries		179,485
Total value of all supplies		1,403,455	PRODUCTION.		
Ores reduced:			Pig-lead ..... pounds..	102,938,105	7,935,140
Galena ..... pounds..	95,517,300	2,342,205	Nickel and cobalt matte ..... pounds..	38,203	5,514
Dry bone ..... pounds..	82,200	1,009	Nickel and cobalt ..... pounds..	310,117	310,117
Blende ..... pounds..	77,797,392	770,185	White lead ..... pounds..	2,156,100	80,244
Silicate of zinc ..... pounds..	43,380,691	379,110	Blue lead ..... pounds..	348,489	12,197
Carbonate of zinc ..... pounds..	6,188,000	35,333	Spelter ..... pounds..	46,477,999	2,862,712
Additional ores of zinc, of which the product is oxide of zinc ..... pounds..	100,678,343	503,392	Zinc oxide ..... pounds..	20,213,631	763,738
Native copper ..... pounds..	58,361,070	5,842,999	Ingot copper ..... pounds..	54,172,017	9,462,253
Nickeliferous pyrrhotite ..... pounds..	14,850,000	150,000	Sulphate of copper or blue vitriol ..... do ...	693,786	43,365
Other ores of copper ..... pounds..	66,699,023	652,801	Gold ..... ounces..	48,801	1,010,570
Gold and silver ores ..... pounds.	18,185,846	a 1,318,545	Silver ..... ounces..	13,220,444	14,882,060
Contents in—			Total value of product		37,373,910
Gold ..... 6,020 ounces.			CAPITAL.		
Silver ..... 1,200,596 ounces.			Capital, fixed		3,336,799
Lead ..... 2,611,988 pounds.			Capital, floating		2,230,615
Total all ores of each metal .. pounds..	481,740,015	11,995,495			

a Estimated.

a Table 67 is merely a summation of the statistics of the various metals already presented in tabular form. To embrace the entire area of the United States the same additions should be made to the amount of base bullion refined and its products as were made in Table 66, by which the figures of those items in this table would be brought up to.

b

	Weight.	Value.
Base bullion treated.....pounds..	102, 385, 905	.....
Pig-lead produced.....pounds..	165, 524, 475	$8, 057, 993
Gold produced.....ounces..	49, 314	1, 019, 313
Silver produced.....ounces..	13, 363, 172	15, 035, 879
Total value of product.....	.....	37, 659, 325

In connection with Table No. 67 and the following ones (Nos. 68 to 74), it is of interest to note the consumption of the various metals as therein illustrated, a summary of which is presented in the following figures, those products of Table 67 to which the figures do not refer remaining unchanged by imports or exports, and it is to be presumed having been consumed or used in the various manufactures of the United States.

c

	Quantity.	Value.
	Pounds.	
Pig-lead consumed in manufactures.....	173, 126, 852	$8, 332, 072
Zinc consumed in manufactures.....	58, 078, 075	3, 394, 272
Copper consumed in manufactures.....	54, 994, 988	9, 573, 808
Value of all metals consumed.....	.....	38, 576, 519

IMPORTS AND EXPORTS.

Tables 68 to 74, inclusive, represent the chief ore and metal importations and exportations during the year ending May 31, 1880.

TABLE 68.—*Imports and exports of ores of copper.*

d

IMPORTS.

From—	Customs district where imported.	Quantity.	Value.
		Pounds.	
England.....	Boston.....	20, 000	$2, 693
Quebec, etc.....	Vermont.....	4, 048, 300	182, 387
Total.....	.....	4, 074, 300	185, 080

e

EXPORTS OF DOMESTIC ORES.

To—	Quantity.	Value.	Customs district whence imported.	Quantity.	Value.
	Pounds.			*Pounds.*	
Germany.....	681, 100	$16, 800	New York and San Francisco.	1, 262, 300	$24, 950
England.....	1, 481, 200	39, 463	....do.....	900, 000	30, 813
Total.....	2, 162, 300	55, 763	.....	2, 162, 300	55, 763

f

EXPORTS OF FOREIGN ORES.

To—	Custom districts whence exported.	Quantity.	Value.
		Pounds.	
England.....	Boston.....	226, 800	$9, 810

Summarizing, we have—

	Quantity.	Value.
	Pounds.	
Imports.....	4, 074, 300	$185, 080
Exports of foreign ore.....	226, 800	9, 810
Imports remaining.....	3, 847, 500	175, 270
Exports of domestic ore.....	2, 162, 300	55, 763
Excess of imports over exports.....	1, 685, 200	119, 507

Thus we see that the ores of copper smelted in this country, as by the table, 139,910,093 pounds, must be diminished by the importation of foreign ores, amounting to 3,847,500 pounds, bringing the former amount down to 136,062,593 pounds, representative of the domestic ores reduced by the smelters east of the 100th meridian. These foreign ores may be classified with those "other than native copper", and were reduced by the smelters of the Atlantic states. Our own eastern smelters complain that the demand for ores far exceeds the supply afforded by domestic mines. The exports contain ores considered too difficult for treatment, or requiring a method distinct from those in use by our own smelters.

It is observed that our imports still exceed the exports by 1,685,200 pounds. Our imports were formerly far in excess of this amount, but upon the imposition of the duty the eastern operators were obliged to allow this branch of their works to decline.

TABLE 69.—*Imports and exports of ores of silver and gold.*

IMPORTS.

Customs district where imported.	Quantity.	Value.
	Pounds.	
New Orleans	224	$10
New York	*a* 83, 640	12, 516
San Francisco	126, 903	23, 066
Lake ports	1, 632, 476	240, 455
Other ports	*a* 3, 813	572
Total	1, 847, 056	276, 649

a Estimated.

EXPORTS OF DOMESTIC ORES.

To—	Quantity.	Value.	Customs district whence exported.	Quantity.	Value.
	Pounds.			*Pounds.*	
Unknown	36, 500	$6, 000	Boston	36, 500	$6, 000
Belgium	000	900	....do	942, 200	167, 500
Germany	81, 700	17, 750	New York	21, 000	9, 000
England	949, 200	168, 700	San Francisco	68, 600	10, 850
Total	1, 068, 300	193, 350		1, 068, 300	193, 350

EXPORTS OF FOREIGN ORES.

Customs district whence exported.	Quantity.	Value.
	Pounds.	
New York	22, 700	$2, 250

Summarizing, we have—

Imports and exports.	Quantity.	Value.
	Pounds.	
Imports	1, 847, 056	$276, 649
Exports of foreign ores	22, 700	2, 250
Imports remaining	1, 824, 356	274, 399
Exports of domestic ore	1, 068, 300	193, 350
Excess of imports over exports	756, 056	81, 049

What became of the 1,824,356 pounds of imported ore is a question, as it has been impossible to trace it to any establishment in this country.

TABLE 70.—*Imports and exports of zinc.*

Imports or exports.	Condition.	Quantities.	Values.
		Pounds.	
Imports of zinc, spelter, or tutenag, and manufacturers of	In blocks or pigs	8, 514, 826	$393, 334
	In sheets	5, 101, 902	260, 056
Exports of domestic zinc-plates	Sheets, pigs, or bars	1, 368, 302	119, 264
Exports of foreign zinc, spelter, or tutenag, and manufactures of	In sheets	48, 350	2, 566

a

TABLE 71.—*Imports and exports of lead.*

	Quantities.	Values.
	Pounds.	
Imports of lead, pigs, bars, and old	8,742,118	$325,076
Exports of domestic lead, and manufactures of	a1,108,866	49,899
Exports of foreign lead, pigs, bars, and old	30,875	1,098

a Estimated.

b

TABLE 72.—*Imports and exports of copper.*

	Quantities.	Values.
	Pounds.	
Imports of copper, pigs, bars, ingots, old, and other, manufactured	5,262,086	$821,329
Exports of domestic copper, pigs, bars, sheets, and old	4,206,258	667,242
Exports of foreign copper, pigs, bars, ingots, old, and other, manufactured	233,457	42,532

c

TABLE 73.—*Imports and exports of tin.*

	Quantities.	Values.
	Cwts.	
Imports of tin in bars, blocks, or pigs	284,960	$6,223,176
Exports of foreign tin in bars, blocks, or pigs	4,116	82,594

TABLE 74.—*Imports and exports of bullion.*

d

	Bars.	GOLD.		SILVER.	
		Bullion.	Dust.	Bars.	Bullion.
Imports	$10,274,188	$3,179,567	$883,090	$985,083	$996,342
Exports, domestic		87,066			6,912,864
Exports, foreign	104,204	195,845			128,664

MINOR MINERALS

OF THE

UNITED STATES.

MICA MINES OF NEW ENGLAND.

By N. S. Shaler.

Mica is obtained from several highly decomposed species of minerals belonging to the group of unsilicates. They constitute a part of all granites, and occur in many other forms of rocks. The well-recognized varieties c are muscovite, which contains potash and some soda; phlogopite when magnesia takes the place of potash and soda; biotite, which adds a considerable amount of iron to the manganese found in phlogopite. Besides these three principal variations rarer varieties occur, known as ripidolite, astrophyllite, lepidomelane, etc., each characterized by certain variations in the proportion or character of their subordinate constituents. Of these various forms only two have, or are likely to have, any commercial importance. These are muscovite, or potash-mica and phlogopite, or magnesia mica. The others are either so rarely found or so little fitted by their physical characters for use that they may be neglected in any economic consideration of the group. All our granite rocks contain micas, and it is to them that we must always look for the supply of this substance; when it occurs with other rocks it is, I believe, universally of unworkable quality.

The first use made of mica in Europe was in the construction of lanterns, a service for which its peculiar d qualities very well fit it. Under the name of Muscovy glass considerable quantities of it have been used in Europe for several centuries.

In Europe and Asia it seems to have been unknown to the ancients; in America, on the other hand, it appears to have been highly prized by the aborigines throughout the Atlantic coast and the Mississippi valley. The reason of the esteem in which they held it is not clear, nor do I know of any descriptions of its use as ornaments among our living Indians. Yet it is a fact that by far the greater part of the Indian graves throughout the region east of the Mississippi contain one or more pieces of mica, which were evidently buried with the corpse. In some cases the amount of mica is so considerable that the upper part of the body seems to have been pretty well covered over with it. In other cases the bit or bits are so small that they would escape the eye of any one not on the lookout for it. This supply of mica seems to have been altogether obtained by the Indians from the mines of the western e Carolinas. There are considerable openings upon these mines which were made by the aborigines, and the opinion of modern writers is to the effect that a good deal of discrimination was shown in selecting the best localities for working. Although I have carefully inquired concerning the existence of pits of ancient date about the mica localities in New England, I have been unable to ascertain that any such evidences of old workings have been found in that part of the country. The presence of mica among the graves is therefore evidence of a certain amount of intercourse among these widely-separated tribes before the settlement of America. So far as I have been able to learn this use of mica as an ornament, and especially its inhumation with the dead, is peculiar to the Indians of this country. It deserves more inquiry than I have been able to give to it.

The mica that is mined in this country and Canada is altogether obtained from the rocks of a granitic character, which probably all belong to deposits of Laurentian, Montalban, or Huronian age. I am informed by Dr. T. f Sterry Hunt that the Canada mica is of the phlogopite or magnesian variety, while that mined in the United States is entirely muscovite. The worked mines of the United States are all in the western part of the Carolinas or in New Hampshire, with the exception of a single locality in Maine, so close to the New Hampshire line that it may fairly be regarded as a part of the last-named district. In these regions mica is very plentiful in the granitic rocks, but is generally distributed in the shape of small crystals, not exceeding at most half an inch on the side. At various points, however, local causes have served to gather the mica into very much larger crystals, which sometimes are as much as a foot in their greatest diameter. The cause of the local deposits of large crystals is not easy to determine. In the Carolinas they appear to occur in distinct veins or dikes of an injected nature. In the New Hampshire district they do not have this distinct character. They rather appear to be obscure beds closely following the general run of the apparent bedding that characterizes the granites in this part of the country. In these beds or dikes the principal part of the mass is feldspar, but there are generally some other conspicuous

a minerals, of which beryl is the most prominent. Scattered through this mass, and usually comprising not more than a few per cent. of its volume, we have the crystals of mica. Sometimes they are aggregated into vein-like belts in the mass of feldspar, at other times they are scattered without much order among the other materials.

In the Carolinas the mica is very apt to have a twisted structure, the bedding planes having been forced out of their natural positions by the pressure incident to the crystallizing process. This distortion is relatively rare in the New England deposits. It may be that this is owing to the very wide nature of the masses in which the crystallizing process simultaneously took place in the northern localities.

The Carolina micas are also much more extensively impregnated with foreign substances in dendritic and other forms, which, crystallizing between the plates, destroy their commercial value. The substance of the sheets is also b much more penetrated by coloring matter than those from New England localities, so that in preparing the mica for the market the proportion rejected is necessarily far greater in the southern mines.

This deeper penetration of altering action in the Carolina localities is a part of the general fact that these more southern regions have not received much glacial wear in recent geological times, and so the rocks near the surface which have long been subjected to the action of weathering agencies remain in place, while in northern regions they have been ground off by the ice of recent glacial periods.

The method of working the deposits depends very much upon the distribution of the mica through the territory it is proposed to explore. The several mines in New Hampshire afford us good instances of the processes of mining the substance as it is usually carried on in New England. In most cases the mica is so distributed that it is most c convenient to approach it by open cuts, when the whole of the material containing the mica is removed as it is in a quarry. A good instance of this may be seen at the Hartford mine, in Groton, New Hampshire. At the Ruggles mine, in Grafton, we have an instance of the other method of occurrence; there the mica lies in one or more vein-like aggregations, the feldspar on either side being scantily furnished with crystals of useful size. In this case the method of working is different; the mine is explored by drifting on the mica, leaving it only in case it is necessary to search for the deposit after the productive ground is exhausted. In the Carolinas the mica occuring in distinct dikes of variable widths, but never of the broad character proper to the deposits in New England, it is necessary to mine the substance by means of regular mining operations. The large size of the aggregations of crystals and the relatively small amount of gangue in the richer parts of the veins compensates for the greater cost as well as for the greater amount of impurities and imperfections found in the crystals.

d As soon as an aggregate of crystals is found the vein-matter is removed in as large masses as possible; these are then carefully split to release the mica, which is then taken to the shops, where the preparation for the market is begun. It should be understood that mica is a crystal with planes of cleavage in one direction, along which it is possible to divide the substance to almost any extent. The first stage of its preparation is to split it into thicknesses that will permit it to be formed into the desired shapes by means of shears such as are commonly used in cutting tin plates. The splitting process is accomplished by means of a wide, thin, wedge-like tool; the blocking into the commercial sizes, by the shears. All the mica is prepared to special order, and practically all of it is used for the single purpose of stove-plates; so this stage of the manufacture brings it into the general shape it is to have when put to use. After the split pieces of the mica crystals leave the hands of the men who cleave and shear them into shape, they are turned over to other persons, generally young women, who split the strips to the desired e thickness and remove all the splintery parts of the sheets, wrap them in pound packages, when they are quite ready for market. No well-accepted classification of the mica has yet been adopted. The price is mainly determined by its size; the smaller sizes, containing about 13 to 15 square inches, are worth at present about 40 to 50 cents per pound; the price rises with the increase of square surface in the pieces until those with 60 to 80 inches of surface, which are rarely used, are worth from $5 to $8 a pound. The mica of different localities differs a good deal in its color and hardness, and somewhat in its endurance to heat. Some of it is greenish, some reddish, and the most preferred of a colorless tint. There seems reason to believe that the colorless mica is the most enduring.

The uses of mica, since it has been a commercial product, are as follows: At first it was used for window-glasses; at a later stage in its commercial history its use for lights was limited to the windows of men-of-war; this use continued down to the present day, but is now ceasing. Inquiry at the Charlestown navy-yard shows that some of it is in store there, but that it has not been put to use for many years. In the earlier stages of the glass-f making industry it was not easy to anneal plates so that they would stand any strong jarring motion; especially was the glass unfit for use when it was likely to receive the shock of artillery firing. This led to its rejection in men-of-war and to the substitution of mica. At present it appears that glass can be so much better annealed that it serves instead of mica in the few windows of our war ships. For a long time it was used in lanterns; this may, indeed, have been the first use to which it was put. I have been unable to ascertain that it is any longer used for this purpose. The smoke of a lantern more readily fouls the surface of mica plates than it does those of glass, and they are more difficult to cleanse, as their surfaces are less smooth than glass. The improvement in the annealing of glass has made it possible to make lanterns of it much more cheaply than those of mica. Owing to these changes in the art of glass-making, mica would no longer be produced for market were it not for the newly-invented fashion of placing plates of it in anthracite stoves so that the stove while air-tight may still show something of the cheerful

glow that comes from its fire. In this particular service mica is not replaceable by any other known substance. a Glass is too fusible as well as too brittle, while the mica is at once elastic and very durable. Even when so exposed as to be often heated to redness it will last for years without breaking down or entirely losing its transparency, and when destroyed it may be easily replaced. Mica plates only endure to advantage in stoves which make use of anthracitic coal; when bituminous coal is used the gases seem to be much more destructive to this substance Moreover, the soot gathers upon it and destroys the cheerful effect which it is the object of the stove-windows to afford. Despite the fact that the production of this substance does not rest upon any very wide basis of utility, for its present use is more of a fashion than a need, we fairly look forward to the continuance and increase of the demand. There has been a tolerably steady growth in this industry for many years. The annual production within the United States probably amounts to somewhere near 2 tons per week or about 100 tons per annum. The b total product is probably within somewhere near $500,000.

It is also reported that the waste clippings from the mica factories are used in a pulverized form in the manufacture of one of the forms of dynamite known as "rend rock", or "mica powder". For such a purpose the absorbent nature of its closely-adjacent plates would appear to fit it.

Mica has been extensively used as a lining for fire-proof safes in a finely-divided form. The abundant interspaces filled with air, and its resistance to high temperatures, makes it an excellent non-conductor when other substances would fuse with heat. It has also been proposed to use the waste clippings of mica factories for admixture with cast-iron in order to produce an anti-friction metal, but the utility of this process has never been demonstrated and seems very questionable. c

Sheet-mica has also been used for many less important purposes, a few of which we will note. It is now used in England to cover photographs, for which its tenuity and flexibility give it advantages over glass. In the Edison telephone it is used for vibrating plates, and the same inventor has used it as a substitute for glass in the reflectors of electric lamps. In the photophone it is used as a vibrating plate. A powder of mica is now used to give a shining surface to wall-paper, on which it is fixed by a gum. In the days of ancient Rome, powdered mica, and perhaps other substances of a somewhat similar nature, was scattered over the surfaces of amphitheaters to give them a pleasant aspect. The progress of the modern arts, both in the ways of utility and ornament, is constantly widening the demands for just such properties as are possessed by mica. Those properties are peculiar, and not readily or cheaply imitable. We may therefore expect that new uses for it will constantly be found. Professor Pumpelly has suggested to me the use of the colored micas in place of colored glass in decorated windows. The d colored micas which are chiefly of the biotite series, occur in great abundance in the Carolina mines. These mines are often very rich, and the actual cost of the small sheets should not be too great to enable it to compete with glass. I do not know whether it will endure the action of the weather so well as the colorless muscovite micas, which, judging from the conditions in natural exposures, would probably last quite as well as glass.

Although the regions known to contain workable mica are numerous, it must take rank among the rarer products of our American rocks. There has been a constant demand for the substance for many years, and many hundred prospects have been examined; still the price of the better kinds remains above that of any other mineral substance except the more precious metals and the gems. So far little skill has been applied to its mining. If the industry remains active long enough to permit a careful system of mining to be developed, there is reason to suppose that a larger product could be furnished at lower prices than those that now prevail. e

The distribution of the rocks which may afford supplies of this substance is such that the production will always be confined to somewhat narrow areas. In the region east of the Mississippi it is not likely that any profitable mines will be found save in the mountain ridges in the older parts of the Appalachian system. The granitic mountains of the Cordilleras of North America may furnish supplies of workable mica, but so far the great mountain system has not furnished anything to our markets.

I have been unable to determine the precise conditions that lead to the formation of large mica crystals in certain places, while in others this less common substance always remains in smaller aggregations. I am inclined to believe that it is in the main due to a freer molecular movement in certain rocks, owing to their more complete reduction to the state in which the molecules were free to group themselves together. The larger crystals are found in granites that seem clearly to have been completely fused, though some of our injected granites do not f show this peculiar feature. It may be worth while to note that our granites with large crystals of mica all occur in the centers of large areas of rocks of a granitic nature, and in the most disturbed part of the Laurentian chain. It may be that this position would be favorable to the more complete fusion of the rocks by heat and motion under pressure, and consequently to the more ready molecular aggregation of the particles. It should be said that large crystals of other kinds, beryls, etc., almost always accompany the development of mica in crystals of such size as to have a commercial value.

Although not prepared to explain the cause of this macrocrystalline character in certain granitic rocks, we may use it as a guide to plans where search may properly be made for mica in forms suitable for commercial uses. Wherever granitic rocks are observed to have the crystalline elements disposed in a large way, especially when the quartz element is not great in quantity, the feldspar in large crystals, and particularly if beryls abound in it,

a mica may reasonably be sought for. These indications are useful, as the mica is always much the least considerable part of the mass, and is often gathered into iron-like aggregations that do not appear on the outcrop. The best plan of exploration in New England, and generally in the Appalachian, is to cross-cut the surface where these conditions are found to occur by open trenches in the rock, extending the trenches at right-angles to the apparent stratification, or, if that be not discernible, from the west by north to the east by south, this direction being generally transverse to the run of the dikes, veins, or beds, if beds they be, in which this mica is contained.

The regions east of the Mississippi that appear to promise most for future search are western North and South Carolina, central Virginia, central, southern, and eastern New Hampshire. Of the Rocky Mountain region not enough is known to give a basis for any advice.

STATISTICS

OF THE

PRODUCTION OF MINOR MINERALS IN THE CENSUS YEAR.

TABLE 75.—*Statistics of the production of minor minerals, by states and counties.*

ASBESTOS.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	Total value of all materials.	PRODUCT, CENSUS YEAR.	
							Tons.	Value.
Grand total		7	$10,000	a17	$1,400		150	$4,312
Georgia	Fulton	1	10,000	a2	250		25	750
Maryland	Baltimore	3		6	200		20	500
Do	Harford	1		2	100		20	500
Total		4		8	300		40	1,000
New York	Richmond	1		4	500		50	1,250
South Carolina	Pickens	1		3	350		35	1,312

a Includes 2 men employed below ground; all others are men employed above ground.

ASPHALTUM.

State.	County.	No. of mines.	Total hands employed.	Amount paid in wages.	PRODUCT, CENSUS YEAR.	
					Tons.	Value.
California	Los Angeles	1	8	$1,500	300	$3,000
Do	Santa Barbara	1	4	720	144	1,440
Total		2	12	2,220	440	4,440

BARYTES.

State.	County.	No. of mines.	Capital real and personal.	Total hands employed.	Amount paid in wages.	Total value of all materials.	PRODUCT, CENSUS YEAR.	
							Tons.	Value.
Grand total		6	$15,577	a63	$7,802	$200	3,608	$37,491
Georgia	Bartow	1	1,000	4	100		200	2,000
Missouri	Washington	2					659	3,236
Pennsylvania	Franklin	1	1,377	a10	642		285	855
Virginia	Pittsylvania	2	13,200	49	7,000	200	2,464	31,400

a Includes 2 boys employed above ground; all others are men employed above ground.

CHROMIC IRON.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			No. of drainage-machines.	No. of hoisting-machines.	Fuel, cords of wood.	Total value of all materials.	PRODUCT.	
						No. of boilers.	No. of engines	Horse-power.					Tons.	Value.
Grand total		5	$176,000	a43	$12,060	1	1	7	2	1	30	$160	2,563	$27,808
California	San Luis Obispo	2	75,000	b16	6,000								2,153	15,508
Maryland	Baltimore	1	80,000	10	1,000	1	1	7	1	1		10	100	3,000
Do	Harford	1		5	200								10	300
Total		2	80,000	15	1,200	1	1	7	1	1		10	110	3,300
Pennsylvania	Lancaster	1	21,000	c12	4,860				1		30	150	300	9,000

a Including 25 men employed below and 1 boy above ground; all others are men employed above ground.
b All employed below ground.
c Including 9 men employed below and 1 boy above ground.

TABLE 75.—*Statistics of the production of minor minerals, by states and counties*—Continued.

COBALT.

State.	County.	No. of mines.	PRODUCT.	
			Tons.	Value.
Pennsylvania (*a*)	Lancaster	1	10,337	$5,109

a Included in nickel mined in Pennsylvania.

CORUNDUM (EMERY).

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			No. of drainage-machines.	No. of hoisting-machines.	Fuel, cords of wood.	Value of explosives.	Total value of all materials.	PRODUCT.	
						No. of boilers.	No. of engines.	Horse-power.						Tons.	Value.
Grand total		3	$320,000	*a* 44	$11,001	2	2	16	3	3	465	$354	$4,997	1,044	$20,280
Massachusetts	Hampden	1	310,000	*b* 31	9,347	1	1	10	2	1	365	254	4,572	600	18,000
North Carolina	Macon	1		6	700									414	8,280
Do	Madison	1	10,000	*c* 7	1,554	1	1	6	1	2	100	100	425	30	3,000
Total		2	10,000	*c* 13	2,254	1	1	6	1	2	100	100	425	444	11,280

a Including 15 men employed below and 1 boy above ground; all others are men employed above ground.
b Including 11 men employed below and 1 boy above ground.
c Including 4 men below ground.

GARNET.

State.	County.	*No. of* mines.	*Total hands* employed.	*Amount paid* in wages.	PRODUCT.	
					Tons.	Value.
Pennsylvania	Delaware	1	2	$832	60	$1,200

GLASS SAND.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			No. of drainage-machines.	Fuel, cords of wood.	Total value of all materials.	PRODUCT.	
						No. of boilers.	No. of engines.	Horse-power.				Tons.	Value.
Grand total		33	$250,100	*a* 332	$96,598	11	11	286	4	330	$11,997	125,052	$230,095
Illinois	La Salle	1	500	10	200							360	324
Indiana	Harrison	2	2,000	*b* 10	2,184				2			3,500	3,425
Do	Washington	1	1,500	*c* 10	1,658	1	1	4	1	40	90	2,024	3,216
Total		3	3,500	*d* 20	3,842	1	1	4	3	40	90	6,424	6,641
Maryland	Anne Arundel	3	52,000	56	12,255	3	4	85	1	80	1,905	17,125	34,250
Massachusetts	Berkshire	3	39,500	*e* 47	11,000	1	1	35		55	6,000	8,000	32,000
New Jersey	Camden	1	100	4	1,050						300	2,275	2,600
Do	Cumberland	4	21,900	32	8,830	1	1	10		75	136	10,500	18,575
Do	Gloucester	5	30,000	24	6,150					30	66	11,600	14,745
Do	Salem	1	3,000	4	1,040							3,120	2,340
Total		11	55,000	64	17,070	1	1	10		105	502	33,495	38,260
New York	Oneida	4	4,000	23	4,450							4,525	6,787
Do	Oswego	3	4,100	17	2,075							3,600	5,400
Total		7	8,100	40	6,525							8,125	12,187
Pennsylvania	Huntingdon	3	11,500	*f* 45	26,100	3	3	52				20,000	43,500
Do	Mifflin	2	80,000	50	19,000	2	1	100		50	3,500	22,523	71,933
Total		5	91,500	*g* 95	45,100	5	4	152		50	3,500	51,523	115,433

a Including 10 boys employed above ground.
b Including 1 boy employed above ground.
c Including 3 boys employed above ground.
d Including 4 boys employed above ground.
e Including 5 boys employed above ground.
f Including 1 boy employed above ground.
g Including 1 boy employed above ground.

TABLE 75.—*Statistics of the production of minor minerals, by states and counties*—Continued.

GRAPHITE.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed	Amount paid in wages.	STEAM-POWER.			No. of drainage-machines.	No. of hoisting-machines.	Total value of all materials.	PRODUCT.	
						No. of boilers.	No. of engines	Horse-power.				Tons.	Value.
Grand total		3	$280,000	a 93	$29,600	3	3	320	2	1	$2,900	940	$49,800
North Carolina	Wake	1	20,000	5	100							200	1,800
Pennsylvania		1	60,000	b 32	10,500	3	2	120	2	1	2,900	440	24,000
New York	Rensselaer	1	200,000	c 56	19,000		1	200				300	24,000

a Including 8 boys employed above ground; all others are men employed above ground.
b Including 2 boys employed above ground.
c Including 6 boys employed above ground.

HYDRAULIC CEMENT.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			No. of drainage-machines.	No. of hoisting-machines.	Fuel, cords of wood.	Total value of all materials.	PRODUCT.	
						No. of boilers.	No. of engines.	Horse-power.					Barrels.	Value.
Grand total		28	$2,873,113	a 2,102	$750,367	62	36	3,445	1	2	2 362	$500,463	2,072,043	$1,852,707
Georgia	Bartow	1	10,000	25	4,800								10,000	12,500
Illinois	La Salle	2	400,000	150	78,000	4	3	100				5,000	120,000	102,000
Maryland	Alleghany	1	50,000	38	12,320	4	1	100			5	2,611	4,000	22,320
Do	Washington	1	25,000	30	8,959						10	7,770	21,794	19,615
Total		2	75,000	68	21,279	4	1	100			15	10,381	25,794	41,944
New York	Erie	3	300,000	b 190	54,500	7	6	340			225	18,500	262,084	238,007
Do	Onondaga	1	150,000	c 60	25,000	2	2	100					40,000	32,000
Do	Ulster	13	1,246,113	d 1,355	492,730	33	17	2,505	1	1	72	420,084	1,419,015	1,101,706
Total		17	1,696,113	e 1,605	572,230	42	25	2,945	1	1	297	448,484	1,721,099	1,461,713
Michigan	Kalamazoo	1	50,000	23	7,500	2	1	45			2,000		7,500	22,500
Pennsylvania	Lehigh	1	125,000	b 100	22,587	5	2	175		1	50	16,500	55,000	60,000
Do	Lawrence	1	150,000	c 45	14,150	3	2	80				12,623	25,000	43,500
Total		2	275,000	f 145	36,737	8	4	255		1	50	29,123	80,000	103,500
Virginia	Rockbridge	1	5,000	14	1,700								4,050	4,050
West Virginia	Jefferson	1	12,000	12	3,121							475	4,500	4,500
Wisconsin	Milwaukee	1	350,000	60	25,000	2	2					7,000	100,000	100,000

a Including 104 boys employed above ground; all others are men employed above ground.
b Including 10 boys employed above ground.
c Including 5 boys employed above ground.
d Including 74 boys employed above ground.
e Including 80 boys employed above ground.
f Including 15 boys employed above ground.

HYDRAULIC LIME.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			Fuel, cords of wood.	Total value of all materials.	PRODUCT.	
						No. of boilers.	No. of engines.	Horse-power.			Bushels.	Value.
New York	Onondaga	6	$93,000	100	$22,750	4	4	155	1,240	$28,500	740,932	$55,319

INFUSORIAL EARTH.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	Total value of all materials.	PRODUCT.	
							Tons.	Value.
Grand total		2	$15,000	13	$1,381	$2,000	1,833	$45,660
Maryland	Calvert	1	10,000	10	1,331	2,000	1,800	45,000
New Jersey	Morris	1	5,000	3	50		33	660

TABLE 75.—*Statistics of the production of minor minerals, by states and counties*—Continued.

KAOLIN.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			No. of drainage-machines.	Fuel, cords of wood.	Total value of all materials.	PRODUCT.	
						No. of boilers.	No. of engines.	Horse-power.				Tons.	Value.
Grand total		9	$436,075	*a* 283	$85,150	9	8	351	13	100	$25,285	23,277	$200,457
Delaware	New Castle	4	285,000	186	62,000	7	6	301	13		21,000	14,510	163,310
Indiana	Lawrence	1	52,000	*b* 11	4,900					100	500	1,000	8,000
Maryland	Cecil	1	50,000	10	250	1	1	8			100	250	1,750
New York	Dutchess	1	4,075	*b* 16	2,400	1	1	42			185	125	1,000
South Carolina	Aiken	2	45,000	60	15,600						3,500	7,392	26,397

a Including 12 men employed below and 4 boys above ground; all others are men employed above ground.
b Including 6 men employed below and 2 boys above ground.

MAGNESIAN LIMESTONE.

State.	County.	No. of mines.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			No. of hoisting-machines.	Cords of wood consumed.	Total value of all materials.	PRODUCT.	
					No. of boilers.	No. of engines.	Horse-power.				Barrels.	Value.
Grand total		2	80	$16,500	1	1	40	1	2,250	$3,000	63,000	$44,175
Georgia	Bartow	1	20	6,000						2,250	15,000	12,000
Do	Catoosa	1	60	10,500	1	1	40	1	2,250	750	48,000	32,175

MANGANESE.

State.	County.	No. of mines.	CAPITAL.				EMPLOYÉS.							Amount paid in wages.	Total value of machinery.
			Real estate.	Plant, etc.	Working capital.	Total.	Men above ground.	Boys above ground.	Men below ground.	Total.	Miners.	Laborers.	Administrative force.		
Grand total		6	$43,000	$14,500	$13,700	$71,800	147	20	65	232	120	102	10	$46,010	$10,500
Georgia	Bartow	1	8,000	10,000	2,000	20,000	100			100	70	25	5	24,000	8,500
Virginia	Augusta	1				39,000	10	10	35	55				10,000	
Do	Campbell	2				600	10			10				700	
Do	Shenandoah	2				12,200	27	10	30	67				11,910	
Total		5	35,600	4,500	11,700	51,800	47	20	65	132	50	77	5	22,610	2,000

State.	County.	No. of drainage-machines.	No. of hoisting-machines.	STEAM-POWER.						No. of horses.	Value.	No. of mules.	Value.	FUEL.	
				No. of engines.	Value.	Horse-power.	No. of boilers.	Value.	Horse-power.					Cords of wood.	Value.
Grand total		3	3	3	$3,650	87	3	$1,800	115	21	$1,980	7	$700	750	$937
Georgia	Bartow			2	3,000	75	2	1,500	100	15	1,500				
Virginia	Augusta	3	3	1		12	1							750	
Do	Campbell														
Do	Shenandoah														
Total		3	3	1	650	12	1	300	15	6	480	7	700	750	937

State.	County.	LUMBER.				Value of explosives.	Total value of all materials.	PRODUCT.	
		Unsawed, feet, linear measure.	Value.	Sawed feet, board-measure.	Value.			Tons.	Value.
Grand total		120,000	$468	600,000	$2,646	$300	$11,813	*a* 10,713	$96,935
Georgia	Bartow					200	6,009	6,720	60,000
Virginia	Augusta						5,443	3,050	27,230
Do	Campbell						100	235	2,625
Do	Shenandoah						270	708	7,080
Total		120,000	468	600,000	2,646	100	5,813	*a* 3,993	36,935

a Besides 637 tons without details as to mines, etc.

TABLE 75.—*Statistics of the production of minor minerals, by states and counties*—Continued.

MICA.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.		Value of explosives.	PRODUCT.	
						No. of boilers.	No. of engines.		Pounds.	Value.
Total		22	$337,900	*a* 272	$65,600	1	1	$6,110	81,669	$127,825
Maine	Oxford	1	12,000	6	1,350			120	2,000	2,000
Massachusetts	Hampden	1	5,000	25	750			600	1,000	1,250
New Hampshire	Grafton	3	314,000	*b* 64	33,850			1,950	36,000	62,900
North Carolina	Haywood	1		5	750			35	1,000	8,000
Do	Jackson	3		8	1,040			78	1,300	1,700
Do	McDowell	1		9	400			34	500	750
Do	Macon	2		*c* 11	3,100			1,050	6,000	9,000
Do	Mitchell	8	5,900	*d* 127	22,210	1	1	2,110	30,942	37,775
Do	Yancy	2	1,000	17	2,150			124	2,927	4,450
Total		17	6,900	*e* 177	29,650	1	1	3,440	42,869	61,675

a Includes 52 men employed below and 20 boys employed above ground, all others being men employed above ground.
b Includes 16 boys employed above ground.
c Includes 8 men employed below ground.
d Includes 44 men employed below and 4 boys employed above ground.
e Includes 52 men employed below and 4 boys employed above ground.

MINERAL SOAP.

State.	County.	No. of mines.	Total hands employed.	Product, tons.
Nevada	Elko	1	*a* 2	50

a Men employed below ground.

NICKEL.

State.	County.	No. of mines.	CAPITAL.				EMPLOYÉS.							Amount paid in wages.	No. of hoisting-machines.
			Real estate.	Plant, etc.	Working capital.	Total.	Men above ground.	Boys above ground.	Men below ground.	Total.	Miners.	Laborers.	Administrative force.		
Grand total		4	$207,500	$115,000	$27,000	$349,500	30	4	36	70	44	24	2	$24,500	1
Massachusetts	Middlesex	1	7,500	15,000	2,000	24,500	10			10	10			5,500	1
Missouri	Madison	1													
Do	Saint François	1													
Total		2													
Pennsylvania	Lancaster	1	200,000	100,000	25,000	325,000	20	4	36	60	34	24	2	19,000	

State.	County.	STEAM-POWER.						No. of horses.	Value.	LUMBER.		Value of explosives.	PRODUCT.	
		No. of engines.	Value.	Horse-power.	No. of boilers.	Value.	Horse-power.			Unsawed, feet, linear measure.	Value.		Pounds.	Value.
Grand total		4	$20,500	155	4	$2,400	203	8	$1,200	30,000	$600	$630	320,908	$104,984
Massachusetts	Middlesex	1	500	25	1	400	43					30	13,440	6,720
Missouri	Madison													5,514
Do	Saint François													2,860
Total													*a* 16,748	8,374
Pennsylvania	Lancaster	3	20,000	130	3	2,000	160	8	1,200	30,000	600	600	299,780	149,890

a The quantity of nickel given is the estimated yield of 58,293 pounds of nickel matte, of which 38,293 pounds were reported from Madison county and 20,000 pounds from Saint François county.

TABLE 75.—*Statistics of the production of minor minerals, by states and counties*—Continued.

NICKEL AND COBALT MATTE.

State.	County.	No. of mines.	PRODUCT.	
			Pounds.	Value.
Missouri	Saint François	1	11,332	$1,586

OCHER.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			Fuel, cords of wood.	Total value of all materials.	PRODUCT.	
						No. of engines.	No. of boilers.	Horse-power.			Tons.	Value.
Grand total		7	$181,050	*a* 100	$24,306	6	7	158	1,230	$1,890	4,037	$135,240
New Jersey	Monmouth	1	5,000	3	600	.....	.....	.....	.....	.....	300	1,350
Vermont	Rutland	3	115,000	52	10,096	4	5	100	530	1,775	1,750	27,750
Virginia	Page	1	25,000	7	2,600	1	1	18	300	100	875	82,500
Do	Rockingham	1	4,050	3	600	.....	.....	.....	.....	15	112	2,240
Do	Chesterfield	1	32,000	*a* 30	10,500	1	1	40	400	.....	1,000	22,000
Total		3	61,050	*a* 45	13,700	2	2	58	700	115	1,987	106,740

a Including 5 men employed below ground; all others are men employed above ground.

OIL-STONE.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			Fuel, cords of wood.	Total value of all materials.	PRODUCT.	
						No. of engines.	No. of boilers.	Horse-power.			Pounds.	Value.
Indiana	Orange	3	$3,500	8	$2,500	1	1	10	100	$110	200,000	$5,350

PYRITE (FOR SULPHURIC ACID).

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	Total value of all materials.	PRODUCT.	
							Tons.	Value.
New York	Saint Lawrence	1	$10,550	*a* 6	$1,200	$365	2,240	$5,000

a Including 3 men employed below ground; all others are men employed above ground.

QUARTZ AND FELDSPAR.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.			Cords of wood consumed.	Total value of all material.	PRODUCT.	
						No. of boilers.	No. of engines.	Horse-power.			Tons.	Value.
Grand total		14	$540,450	110	$38,667	2	2	28	1,138	$13,167	21,571	$103,578
Maryland	Cecil	1	25,000	10	3,875	.....	.....	.....	325	1,035	1,475	10,325
Do	Harford	4	80,000	3	9,040	1	1	20	813	9,603	2,551	19,784
Total		5	105,000	22	12,915	1	1	20	1,138	10,638	4,026	30,109
Massachusetts	Hampden	2	254,000	23	12,300	.....	.....	.....	.....	1,600	3,400	44,000
Michigan	Marquette	2	4,250	45	8,000	.....	.....	.....	.....	.....	8,738	18,557
New Hampshire	Sullivan	1	125,000	12	2,100	.....	.....	.....	.....	700	3,500	3,400
New York	Washington	4	52,200	17	3,352	1	1	8	.....	229	1,907	7,812

TABLE 75.—*Statistics of the production of minor minerals, by states and counties*—Continued.

SCYTHE-STONES.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	PRODUCT.	
						Gross.	Value.
Grand total		4	$6,700	17	$2,178	5,675	$19,638
New Hampshire	Grafton	1	2,000	7	900	5,000	16,250
Vermont	Washington	2	3,700	4	478	175	1,763
Do	Windsor	1	1,000	6	800	500	1,625
Total		3	4,700	10	1,278	675	3,388

SHOEMAKERS' SANDSTONES.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	PRODUCT.	
						Pounds.	Value.
Indiana	Orange	2	$1,000	*a* 4	$1,500	150,000	$1,300

a Including 2 boys employed above ground.

SOAPSTONE.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	STEAM-POWER.		Fuel, cords of wood.	Total value of all materials.	PRODUCT.	
						No. of boilers.	No. of engines.			Tons.	Value.
Grand total		11	$202,000	*a* 113	$29,455	2	2	300	$2,841	8,441	$66,665
Georgia	Cherokee	1	1,400	8	300	.....	.....	.....	100	200	500
Do	Murray	1	6,000	4	90	.....	.....	.....	.....	120	210
Total		2	7,400	12	390	.....	.....	.....	100	320	710
Maryland	Baltimore	1	12,000	4	734	.....	.....	.....	114	300	1,950
New Hampshire	Hillsborough	1	100,000	30	12,000	1	1	300	950	2,000	30,000
North Carolina	Cherokee	1	2,500	10	2,200	.....	.....	.....	.....	450	4,500
Do	Swain	1	2,500	5	300	.....	.....	.....	.....	60	600
Total		2	5,000	15	2,500	.....	.....	.....	.....	510	5,100
Pennsylvania	Franklin	1	10,000	*a* 6	1,650	.....	.....	.....	150	11	55
Do	Montgomery	1	37,000	21	6,281	1	1	.....	402	4,000	17,000
Total		2	47,000	*a* 27	7,931	1	1	.....	552	4,011	17,055
Vermont	Windham	2	25,500	19	5,100	.....	.....	.....	625	900	7,850
Do	Windsor	1	6,000	6	800	.....	.....	.....	500	400	4,000
Total		3	31,500	25	5,900	.....	.....	.....	1,125	1,300	11,850

a Includes 6 men employed below ground, all others being men employed above ground.

TALC.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	Total value of all materials.	PRODUCT.	
							Tons.	Value.
New York	Saint Lawrence	3	$24,100	65	$28,090	$15,300	4,210	$54,730

WHETSTONE.

State.	County.	No. of mines.	Capital, real and personal.	Total hands employed.	Amount paid in wages.	Total value of all materials.	PRODUCT.	
							Gross.	Value.
Vermont	Orleans	2	$74,000	10	$2,175	$300	2,000	$5,800

TABLE 76.—*Statistics of the production of minor minerals, by states.*

[A summary of Table 75.]

ASBESTOS.

	States.	Number of counties.	Number of mines.	Total marketable product for census year, tons (unless otherwise specified).	Value.	EMPLOYÉS. Number of men below ground.	Number of boys below ground.	Number of men above ground.	Number of boys above ground.	Total number of employés.	Number of miners.	Number of laborers.	Administrative force.	Total wages paid.	CAPITAL. Real estate.	Plant.	Working capital.	Total capital.	Value of materials used.	Total value of machinery.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Total	5	7	150	$4,312	2	....	15	....	17	....	....	....	$1,400	.....	.....	.....	.....	.....	.....
1	Georgia	1	1	25	750	2	....	.....	....	2	....	....	....	250	.....	.....	.....	.....	.....	.....
2	Maryland	2	4	40	1,000	....	....	8	....	8	....	....	....	300	.....	.....	.....	.....	.....	.....
3	New York	1	1	50	1,250	....	....	4	....	4	....	....	....	500	.....	.....	.....	.....	.....	.....
4	South Carolina	1	1	35	1,312	....	....	3	....	3	....	....	....	350	.....	.....	.....	.....	.....	.....

ASPHALTUM.

	Total	2	2	444	$4,440	...	....	12	....	12	....	....	....	$2,220	.....	.....	.....	.....	.....	.....
1	California	2	2	444	4,440	....	....	12	....	12	....	....	....	2,220	.....	.....	.....	.....	.....	.....

BARYTES.

	Total	4	*6	3,608	$37,491	....	....	61	2	63	....	....	....	$7,802	.....	.....	.....	$15,577	$200	.....
1	Georgia	1	1	200	2,000	....	....	4	....	4	....	....	....	160	.....	.....	.....	1,000	.....	.....
2	Pennsylvania	1	1	285	855	....	....	8	2	10	....	....	....	642	.....	.....	.....	1,377	.....	.....
3	Virginia	1	2	2,464	31,400	....	....	49	....	49	....	....	....	7,000	.....	.....	.....	13,200	200	.....
4	Missouri	1	2	659	3,236	....	..	.....	....	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....

CHROMIC IRON.

	Total	4	5	2,503	$27,808	25	....	17	1	43	....	....	....	$12,080	.....	.....	.....	$176,000	$160	.....
1	California	1	2	2,153	15,508	16	....	.....	....	16	....	....	....	6,000	.....	.....	.....	75,000	.....	.....
2	Maryland	2	2	110	3,300	....	....	15	....	15	....	....	....	1,200	.....	.....	.....	80,000	10	.....
3	Pennsylvania	1	1	300	9,000	9	...	2	1	12	....	....	....	4,880	.....	.....	.....	21,000	150	.....

COBALT (SEE ALSO NICKEL AND COBALT).

	Total	1	1	10,337	$5,169	....	....	.....	....	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....
1	Pennsylvania	1	1	10,337	5,169	..	....	.....	...	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....

CORUNDUM.

	Total	3	3	1,044	$29,280	15	....	28	1	44	....	....	....	$11,601	.....	.....	.....	$320,000	$4,997	.....
1	Massachusetts	1	1	600	18,000	11	....	19	1	31	....	....	....	9,347	.....	.....	.....	310,000	4,572	.....
2	North Carolina	2	2	444	11,280	4	....	9	....	13	...	...	....	2,254	.....	.....	.....	10,000	425	.....

GARNET.

	Total	1	1	60	$1,200	....	..	2	....	2	....	....	....	$832	.....	.....	.....	.....	.....	.....
1	Pennsylvania	1	1	60	1,200	....	....	2	....	2	....	....	....	832	.....	.....	.....	.....	.....	.....

TABLE 76.—*Statistics of the production of minor minerals, by states.*

[A Summary of Table 75.]

ASBESTOS.

Number of cords of wood used annually.	Value.	Unsawed lumber (other than for fuel).	Value.	Sawed lumber, feet, board measure.	Value.	Number of horses.	Value.	Number of mules.	Value.	STEAM-POWER. Number of steam-engines.	Value.	Horse-power of steam-engines.	Number of boilers.	Value.	Horse-power.	Cost of explosives.	Number of hoisting-machines.	Number of drainage-machines.	Remarks.	
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
		Lin. ft.																		
																				1
																				2
																				3
																				4

ASPHALTUM.

																				1

BARYTES.

																				1
																				2
																				3
																				4

CHROMIC IRON.

30										1		7	1				1	2		
																				1
										1		7	1				1	1		2
30																		1		3

COBALT (SEE ALSO NICKEL AND COBALT).

																				1

CORUNDUM.

465										2		16	2			$354	3	3		
305										1		10	1			254	1	2		1
100										1		6	1			100	2	1		2

GARNET.

																				1

TABLE 76.—*Statistics of the production of minor minerals, by states*—Continued.

GLASS SAND.

	States.	Number of counties.	Number of mines.	Total marketable product for census year, tons, (unless otherwise specified).	Value.	EMPLOYÉS. Number of men below ground.	Number of boys below ground.	Number of men above ground.	Number of boys above ground.	Total number of employés.	Number of miners.	Number of laborers.	Administrative force.	Total wages paid.	CAPITAL. Real estate.	Plant.	Working capital.	Total capital.	Value of materials used.	Total value of machinery.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Total	13	33	125,052	$239,095	....	....	322	10	332	....	....	....	$96,598	....	....	....	$250,100	$11,907	....
1	Illinois	1	1	360	324	....	....	10	....	10	....	....	....	200	....	....	....	500	....	....
2	Indiana	2	3	6,424	6,641	....	....	16	4	20	....	....	....	3,842	....	....	....	3,500	00	....
3	Maryland	1	3	17,125	34,250	....	....	50	....	50	....	....	....	12,255	....	....	....	52,000	1,905	....
4	Massachusetts	1	3	8,000	32,000	....	....	42	5	47	....	....	....	11,000	....	....	....	30,500	6,000	....
5	New Jersey	4	11	33,405	38,260	....	....	64	....	64	....	....	....	17,076	....	....	....	55,000	502	....
6	New York	2	7	8,125	12,187	....	....	40	....	40	....	....	....	6,525	....	....	....	8,100	....	....
7	Pennsylvania	2	5	51,523	115,433	....	....	94	1	95	....	....	....	45,100	....	....	....	91,500	3,500	....

GRAPHITE.

	Total	3	3	940	$49,800	....	....	85	8	93	....	....	....	$29,600	....	....	....	$280,000	$2,000	....
1	New York	1	1	300	24,000	....	....	50	6	56	....	....	....	19,000	....	....	....	200,000	....	....
2	North Carolina	1	1	200	1,800	....	....	5	....	5	....	....	....	100	....	....	....	20,000	....	....
3	Pennsylvania	1	1	440	24,000	....	....	30	2	32	....	....	....	10,500	....	....	....	60,000	2,000	....

HYDRAULIC CEMENT.

	Total	13	28	a 2,072,943	$1,852,707	....	....	1,908	104	2,102	....	....	....	$750,367	....	....	....	$2,873,113	$500,463	....
1	Georgia	1	1	10,000	12,500	....	....	25	....	25	....	....	....	4,800	....	....	....	10,000	....	....
2	Illinois	1	2	120,000	102,000	....	....	150	....	150	....	....	....	78,000	....	....	....	400,000	5,000	....
3	Maryland	2	2	25,704	41,044	....	....	68	....	68	....	....	....	21,270	....	....	....	75,000	10,381	....
4	Michigan	1	1	7,500	22,500	....	....	23	....	23	....	....	....	7,500	....	....	....	50,000	....	....
5	New York	3	17	1,721,099	1,461,713	....	....	1,516	89	1,605	....	....	....	572,230	....	....	....	1,606,113	448,484	....
6	Pennsylvania	2	2	80,000	103,500	....	....	130	15	145	....	....	....	36,737	....	....	....	275,000	29,123	....
7	Virginia	1	1	4,050	4,050	....	....	14	....	14	....	....	....	1,700	....	....	....	5,000	....	....
8	West Virginia	1	1	4,500	4,500	....	....	12	....	12	....	....	....	3,121	....	....	....	12,000	475	....
9	Wisconsin	1	1	100,000	100,000	....	....	60	....	60	....	....	....	25,000	....	....	....	350,000	7,000	....

HYDRAULIC LIME.

	Total	1	6	b 749,032	$55,319	....	....	100	....	100	....	..	....	$22,750	....	....	....	$93,000	$28,500	....
1	New York	1	6	749,032	55,319	....	....	100	....	100	....	....	....	22,750	....	....	....	93,000	28,500	....

INFUSORIAL EARTH.

	Total	2	2	1,833	$45,600	....	....	13	....	13	....	....	....	$1,381	....	....	....	$15,000	$2,000	....
1	Maryland	1	1	1,800	45,000	....	....	10	....	10	....	....	....	1,331	....	....	....	10,000	2,000	....
2	New Jersey	1	1	33	600	....	....	3	....	3	....	....	....	50	....	....	....	5,000	....	....

KAOLIN.

	Total	5	9	23,277	$200,457	12	....	267	4	283	....	....	....	$85,150	....	....	....	$436,075	$25,285	....
1	Delaware	1	4	14,510	163,310	....	....	186	....	186	....	....	....	62,000	....	....	....	285,000	21,000	....
2	Indiana	1	1	1,000	8,000	6	....	3	2	11	....	....	....	4,000	....	....	....	52,000	500	....
3	Maryland	1	1	250	1,750	....	....	10	....	10	....	....	....	250	....	....	....	50,000	100	....
4	New York	1	1	125	1,000	6	....	8	2	16	....	....	....	2,400	....	....	....	4,075	185	....
5	South Carolina	1	2	7,392	26,397	....	....	60	....	60	....	..	....	15,600	....	....	....	45,000	3,500	....

a Barrels.

b Bushels.

TABLE 76.—*Statistics of the production of minor minerals, by states*—Continued.

GLASS SAND.

Number of cords of wood used annually.	Value.	Unsawed lumber (other than for fuel).	Value.	Sawed lumber, feet, board measure.	Value.	Number of horses.	Value.	Number of mules.	Value.	STEAM-POWER. Number of steam-engines.	Value.	Horse-power of steam-engines.	Number of boilers.	Value.	Horse-power.	Cost of explosives.	Number of hoisting-machines.	Number of drainage-machines.	Remarks.	
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
330	....	.....	.....	.....	.....	....	.....	....	.....	11	.....	286	11	.....	...	.....	...	4		
.....	.....	.....	.....	.....	.....	....	.....	...	.....	...	.....	.....	....	.....	...	.....	...	...	.....	1
40	....	.....	.....	.....	.....	....	.....	....	.....	1	.....	4	1	.....	...	.....	...	3	.....	2
80	.....	.....	.....	.....	.....	....	.....	....	.....	4	.....	85	3	.....	...	.....	...	1	.....	3
55	....	.....	.....	.....	.....	....	.....	....	.....	1	.....	35	1	.....	...	.....	...	...	.....	4
105	.....	.....	.....	.....	.....	....	.....	....	.....	1	.....	10	1	.....	...	.....	...	...	.....	5
.....	..	.....	.....	.....	.....	....	.....	....	.....	...	.....	.....	...	.....	...	.....	...	..	.....	6
50	.....	.....	.....	.....	.....	....	.....	....	.....	4	.....	152	5	.....	...	.....	...	..	.....	7

GRAPHITE.

.....	.....	.....	.....	.....	.....	....	.....	....	.....	3	.....	320	3	.....	...	.....	1	2	Exclusive of returns from Dixon Crucible Company, which were received too late for tabulation.	
.....	.....	.....	.....	.....	.....	....	.....	....	.....	1	.....	200	...	.....	...	.....	...	...	.....	1
.....	.....	.....	.....	.....	.....	....	.....	....	.....	...	.....	.....	...	.....	...	.....	...	...	.....	2
.....	.....	.....	.....	.....	.....	....	.....	....	.....	2	.....	120	3	.....	...	.....	1	2	.....	3

HYDRAULIC CEMENT.

2,362	.....	.....	.....	.....	.....	....	.....	....	.....	36	.....	3,445	62	.....	...	.....	2	1	Exclusive of returns from Howe's Cave Lime and Cement Company and Howe's Cave Association, as no answers to the schedules were received from them.	
.....	.....	.....	.....	.....	.....	....	.....	....	.....	...	.....	.....	..	.....	...	.....	...	...		1
.....	.....	.....	.....	.....	.....	....	.....	....	.....	3	.....	100	4	.....	...	.....	...	...		2
15	.....	.....	.....	.....	.....	....	.....	....	.....	1	.....	100	4	.....	...	.....	...	...	.....	3
2,000	.....	.....	.....	.....	.....	....	.....	....	.....	1	.....	45	2	.....	...	.....	...	...	.....	4
207	.....	.....	.....	.....	.....	....	.....	....	.....	25	.....	2,945	42	.....	...	.....	1	1	.....	5
50	.....	.....	.....	.....	.....	....	.....	....	.....	4	.....	255	8	.....	...	.....	1	...	.....	6
.....	.....	.....	.....	.....	.....	....	.....	....	.....	...	.....	.....	...	.....	...	.....	...	...	.....	7
.....	.....	.....	.....	.....	.....	....	.....	....	.....	...	.....	.....	...	.....	...	.....	...	...	.....	8
.....	.....	.....	.....	.....	.....	....	.....	....	.....	2	.....	.....	2	.....	...	.....	...	...	.....	9

HYDRAULIC LIME.

1,240	.....	.....	....	.....	.....	....	.....	....	.....	4	.....	155	4	.....	...	.....	...	...		
1,240	....	.....	.....	.....	.....	....	.....	....	.....	4	.....	155	4	.....	...	.....	...	...	.....	1

INFUSORIAL EARTH.

.....	.....	.....	.....	.....	.....	....	.....	....	.....	...	.....	.....	...	.....	...	.....	...	...		
.....	.....	.....	.....	.....	.....	....	.....	....	.....	....	.....	....	..	.....	..	.....	...	...	.....	1
.....	.....	.....	.....	.....	.....	....	.....	....	.....	....	.....	....	...	.....	...	.....	...	...	.....	3

KAOLIN.

100	.....	.....	.....	.....	.....	....	.....	....	.....	8	.....	351	9	.....	...	20	...	13		
....	.....	.....	.....	.....	.....	....	.....	....	.....	6	.....	301	7	.....	...	.....	...	13	.....	1
100	.....	.....	.....	.....	.....	....	.....	....	.....	...	.....	.....	..	.....	...	.....	...	...	.....	2
.....	.....	.....	.....	.....	.....	....	.....	....	.....	1	.....	8	1	.....	..	.....	...	...	.....	3
.....	.....	.....	.....	.....	.....	....	.....	....	.....	1	.....	42	1	.....	...	20	...	...	.....	4
.....	.....	.....	.....	.....	.....	....	.....	....	.....	...	.....	.....	...	.....	...	.....	...	..	.....	5

TABLE 76.—*Statistics of the production of minor minerals, by states*—Continued.

MAGNESIAN LIMESTONE.

	States.	Number of counties.	Number of mines.	Total marketable product for census year, tons (unless otherwise specified).	Value.	EMPLOYÉS. Number of men below ground.	Number of boys below ground.	Number of men above ground.	Number of boys above ground.	Total number of employés.	Number of miners.	Number of laborers.	Administrative force.	Total wages paid.	CAPITAL. Real-estate.	Plant.	Working capital.	Total capital.	Value of materials used.	Total value of machinery.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Total	2	2	a63,000	$44,175	....	....	80	....	80	....	....	....	$16,500	.....	.....	.....	.....	$3,000	.....
1	Georgia	2	2	63,000	44,175	....	....	80	....	80	....	....	....	16,500	.....	.....	.....	.....	3,000	.....

MANGANESE.

	Total	4	6	10,713	$96,935	65	....	147	20	232	120	102	10	$46,610	$43,600	$14,500	$13,700	$71,800	$11,813	$10,500
1	Georgia	1	1	5,720	60,000	....	..	100	....	100	70	25	5	24,000	8,000	10,000	2,000	20,000	6,000	8,500
2	Virginia	3	5	3,993	36,935	65	....	47	20	132	50	77	5	22,610	35,600	4,500	11,700	51,800	5,813	2,000

MICA.

	Total	9	22	b81,000	$127,825	52	....	200	20	272	....	....	....	$65,600	.....	.....	.....	$337,900	.....	.....
1	Maine	1	1	2,000	2,000	....	....	6	...	6	....	....	....	1,350	.....	.....	.....	12,000	.....	.....
2	Massachusetts	1	1	1,000	1,250	...	....	25	..	25	....	....	....	750	.....	.....	.....	5,000	.....	.....
3	New Hampshire	1	3	30,000	62,000	....	....	48	16	64	....	....	....	33,850	.....	.....	.....	314,000	.....	.....
4	North Carolina	6	17	42,000	61,575	52	...	121	4	177	....	....	....	29,650	.....	.....	.....	6,900	.....	.....

MINERAL SOAP.

	Total	1	1	50	.....	2	...	.....	..	2	...	....	....	.....	.....	.....	.....	.....	.....	.....
1	Nevada	1	1	50	.....	2	....	.....	....	2	...	....	....	.....	.....	.....	.....	.....	.....	.....

NICKEL.

	Total	4	4	b329,908	$164,984	36	....	30	4	70	44	24	2	$24,500	$207,500	$115,000	$27,000	$349,500	.....	.....
1	Massachusetts	1	1	13,440	6,720	....	....	10	....	10	10	....	....	5,500	7,500	15,000	2,000	24,500	.....	.....
2	Missouri	2	2	16,748	8,374	....	....	.....	....	.....	.....	....	....	.....	.....	.....	.....	.....	.....	.....
3	Pennsylvania	1	1	299,780	149,890	36	....	20	4	60	34	24	2	19,000	200,000	100,000	25,000	325,000	.....	.....

NICKEL AND COBALT.

	Total	1	1	b11,332	$1,586	....	....	.....	...	.....	...	....	...	.....	.....	.....	.....	.....	.....	.....
1	Missouri	1	1	11,332	1,586	....	....	.....	...	.....	...	....	...	.....	.....	.....	.....	.....	.....	.....

OCHER.

	Total	5	7	4,037	$135,840	5	....	95	....	100	....	....	....	$24,396	.....	.....	.....	$181,050	$1,890	.....
1	New Jersey	1	1	300	1,350	....	....	3	....	3	....	....	....	600	.....	.....	.....	5,000	.....	.....
2	Vermont	1	3	1,750	27,750	....	....	52	...	52	....	....	....	10,096	.....	.....	.....	115,000	1,775	.....
3	Virginia	3	3	1,987	106,740	5	....	40	....	45	....	....	...	13,700	.....	.....	.....	61,050	115	.....

OIL-STONE.

	Total	1	3	b200,000	$5,350	....	...	8	....	8	...	....	....	$2,590	.....	.....	.....	$3,500	$110	.....
1	Indiana	1	3	200,000	5,350	...	...	8	....	8	....	....	....	2,590	.....	.....	.....	3,500	110	.....

a Barrels. b Pounds.

TABLE 76.—*Statistics of the production of minor minerals, by states*—Continued.

MAGNESIAN LIMESTONE.

Number of cords of wood used annually.	Value.	Unsawed lumber (other than for fuel).	Value.	Sawed lumber, feet, board measure.	Value.	Number of horses.	Value.	Number of mules.	Value.	STEAM-POWER. Number of steam-engines.	Value.	Horse-power of steam-engines.	Number of boilers.	Value.	Horse-power.	Cost of explosives.	Number of hoisting-machines.	Number of drainage-machines.	Remarks.	
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
		Lin. ft.																		
2,250	.....	.....	.....	.....	.....	...	.....	...	.....	1	.....	40	1	.....	...	.....	1	...		
2,250	.....	.....	.....	.....	.....	...	.....	...	.....	1	.....	40	1	.....	...	.....	1	...	.....	1

MANGANESE.

750	$937	120,000	$468	690,000	$2,646	21	$1,980	7	$700	3	$3,650	87	3	$1,800	115	$300	3	3	Exclusive of 637 tons reported without details as to mining, etc.	
.....	.....	.....	.....	.....	.....	15	1,500	....	.....	2	3,000	75	2	1,500	100	200	....	....	.....	1
750	937	120,000	468	690,000	2,646	6	480	7	700	1	650	12	1	300	15	100	3	3	.....	2

MICA.

.....	.....	.....	.....	.....	.....	...	.....	...	.....	1	.....	.....	1	.....	...	6,110	...	...	There are a few mica mines in Virginia or West Virginia from which no returns have been received.	
.....	.....	.....	.....	.....	.....	...	.....	...	.....	....	.....	.....	...	.....	...	120	...	...	.....	1
.....	.....	.....	.....	.....	.....	...	.....	...	.....	..	.....	.....	...	.....	..	600	...	...	.....	2
.....	.....	.....	.....	.....	.....	...	.....	...	.....	....	.....	.....	..	.....	...	1,950	...	...	.....	3
.....	.....	.....	.....	.....	.....	...	.....	...	.....	1	.....	.....	1	.....	...	3,440	...	...	.....	4

MINERAL SOAP.

.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...		
.....	.....	.....	.....	.....	.....	...	.....	..	.....	...	.....	.....	...	.....	..	.....	...	...	.....	1

NICKEL.

.....	.....	30,000	$600	.....	.....	8	$1,200	....	.....	4	$20,500	155	4	$2,400	203	$630	1	...	.....	
.....	.....	.....	.....	.....	.....	...	.....	..	.....	1	500	25	1	400	43	30	1	...	.....	1
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	...	...	.....	...	.....	...	...	.....	2
.....	.....	30,000	600	.....	.....	8	1,200	....	.....	3	20,000	130	3	2,000	160	600	...	..	.....	3

NICKEL AND COBALT.

.....	.....	.....	.....	.....	.....	...	.....	..	.....	...	.....	.....	...	.....	..	.....	...	...	.....	
.....	.....	.....	.....	.....	.....	...	.....	...	.....	..	.....	.....	...	.....	...	.....	...	...	.....	1

OCHER.

1,230	.....	.....	....	.....	.....	...	.....	...	.....	7	.....	*158	6	.....	...	.....	...	...	There are a few ocher mines in Virginia or West Virginia from which no returns have been received.	
.....	.....	.....	.....	.....	.....	...	.....	..	.....	..	.....	.....	...	.....	...	.....	...	...	.....	1
530	.....	.....	.....	.....	.....	...	.....	..	.....	5	.....	100	4	.....	...	.....	...	...	.....	2
700	.....	.....	.....	.....	.....	...	.....	...	.....	2	.....	58	2	.....	...	.....	...	...	.....	3

OIL-STONE.

100	.....	.....	.....	.....	.....	..	.....	...	.....	1	.....	10	1	.....	...	.....	...	...	.....	
100	.....	.....	.....	.....	.....	..	.....	...	....	1	.....	10	1	.....	...	.....	...	...	.....	1

TABLE 76.—*Statistics of the production of minor minerals, by states*—Continued.

PYRITE.

	States.	Number of counties.	Number of mines.	Total marketable product for census year, tons (unless otherwise specified).	Value.	EMPLOYES. Number of men below ground.	Number of boys below ground.	Number of men above ground.	Number of boys above ground.	Total number of employés.	Number of miners.	Number of laborers.	Administrative force.	Total wages paid.	CAPITAL. Real estate.	Plant.	Working capital.	Total capital.	Value of materials used.	Total value of machinery.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Total	1	1	2,240	$5,000	3	....	3	....	6	..	....	....	$1,200	.....	.....	.....	$10,550	$365	.....
1	New York	1	1	2,240	5,000	3	....	3	....	6	....	....	....	1,200	.....	.....	.....	10,550	365	.....

QUARTZ.

	Total	6	14	21,571	$103,878	....	....	119	....	119	....	....	....	$38,667	.....	.....	.....	$540,450	$13,167	.....
1	Maryland	2	5	4,020	30,100	....	....	22	....	22	....	....	....	12,915	.....	.....	.....	105,000	10,038	.....
2	Massachusetts	1	2	3,400	44,000	....	....	23	....	23	....	....	....	12,300	.....	.....	.....	254,000	1,000	.....
3	Michigan	1	2	8,738	18,557	....	....	45	....	45	....	....	....	8,000	.....	.....	.....	4,250	.....	.....
4	New Hampshire	1	1	3,500	3,400	....	..	12	....	12	....	....	....	2,100	.....	.....	.....	125,000	700	.....
5	New York	1	4	1,937	7,812	....	....	17	....	17	....	....	....	3,352	.....	.....	.....	52,200	229	.....

SCYTHE-STONE.

	Total	3	4	*a* 5,675	$10,638	....	....	17	....	17	....	....	....	$2,178	.....	.....	.....	$6,700	.....	.....
1	New Hampshire	1	1	5,000	10,250	...	....	7	....	7	....	....	...	900	.....	.....	.....	2,000	.....	.....
2	Vermont	2	3	675	3,388	....	....	10	...	10	....	....	....	1,278	.....	.....	.....	4,700	.....	.....

SHOEMAKER'S SANDSTONE.

	Total	1	2	*b* 150,000	$2,300	....	....	2	2	4	....	....	....	$1,500	.....	.....	.....	$1,000	.....	.....
1	Indiana	1	2	150,000	2,300	....	....	2	2	4	..	....	...	1,500	.....	.....	.....	1,000	.....	.....

SOAPSTONE.

	Total	10	11	8,441	$66,665	6	....	107	....	113	....	....	....	$20,455	.....	.....	.....	$202,000	$2,841	.....
1	Georgia	2	2	320	710	....	....	12	....	12	...	....	....	390	.....	.....	.....	7,400	100	.....
2	Maryland	1	1	300	1,950	....	....	4	...	4	....	....	....	734	.....	.....	.....	12,000	114	.....
3	New Hampshire	1	1	2,000	30,000	....	....	30	....	30	....	....	....	12,000	.....	.....	.....	100,000	950	.....
4	North Carolina	2	2	510	5,100	...	....	15	....	15	....	....	....	2,500	.....	.....	.....	5,000	.....	.....
5	Pennsylvania	2	2	4,011	17,055	6	....	21	....	27	....	....	....	7,931	.....	.....	.....	47,000	552	.....
6	Vermont	2	3	1,300	11,850	....	....	25	....	25	....	....	....	5,900	.....	.....	.....	31,500	1,125	.....

TALC.

	Total	1	3	4,210	$54,730	...	....	65	....	65	....	...	....	$28,000	.....	.....	.....	$24,100	$15,360	.....
1	New York	1	3	4,210	54,730	...	....	65	....	65	....	....	....	28,000	.....	.....	.....	24,100	15,360	.....

WHETSTONE.

	Total	1	2	*a* 2,900	$5,800	....	....	10	....	10	....	....	....	$2,175	.....	.....	.....	$74,000	$300	.....
1	Vermont	1	2	2,900	5,800	....	....	10	....	10	....	....	....	2,175	.....	.....	.....	74,000	300	.....

a Gross. *b* Pounds.

TABLE 76.—*Statistics of the production of minor minerals, by states*—Continued.

PYRITE.

Number of cords of wood used annually.	Value.	Unsawed lumber (other than for fuel).	Value.	Sawed lumber, feet, board measure.	Value.	Number of horses.	Value.	Number of mules.	Value.	STEAM-POWER. Number of steam-engines.	Value.	Horse-power of steam-engines.	Number of boilers.	Value.	Horse-power.	Cost of explosives.	Number of hoisting-machines.	Number of drainage-machines.	Remarks.	
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
		Lin. ft.																		
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	1

QUARTZ.

1,138	.....	.....	.....	.....	.....	...	.....	...	.....	2	.....	28	2	.....	...	.....	...	...	.....	
1,138	....	.....	.....	.....	.....	...	.....	...	.....	1	.....	20	1	.....	...	.....	...	...	.....	1
.....	.....	.....	.....	.....	.....	...	.....	...	.....	..	.....	.....	...	.....	...	.....	...	...	.....	2
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	..	.....	...	.....	..	...	.....	3
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	4
.....	.....	.....	....	.....	.....	...	.....	...	.....	1	.....	8	1	.....	...	.....	...	...	.....	5

SCYTHE-STONE.

.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	The value of the product is of the manufactured article. The cost of "manufacturing" does not appear under "Wages."	
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	1
.....	.....	.....	.....	.....	.....	...	.....	...	.....	..	.....	.....	...	.....	...	.....	...	...	.....	2

SHOEMAKER'S SANDSTONE.

.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	1

SOAPSTONE.

300	.....	.....	.....	.....	.....	...	.....	...	.....	2	.....	.....	2	.....	...	.....	...	...	.....	
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	1
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	2
300	.....	.....	.....	.....	.....	...	.....	...	.....	1	.....	.....	1	.....	...	.....	...	...	.....	3
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	4
.....	.....	.....	.....	.....	.....	...	.....	...	.....	1	.....	.....	1	.....	...	.....	...	...	.....	5
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	..	.....	6

TALC.

.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	1

WHETSTONE.

.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	
.....	.....	.....	.....	.....	.....	...	.....	...	.....	...	.....	.....	...	.....	...	.....	...	...	.....	1